JULY, 1961

TRAFFIC ENGINEERING

- Washington — Your Capitol City
- Vehicle Detection for Traffic Analysis and Control
- The History of an Idea
- Emergency Vehicle Control

INSTITUTE OF TRAFFIC ENGINEERS
ITE
FOUNDED 1930

TRAFFIC FINES PAID "ON THE SPOT"

WITH

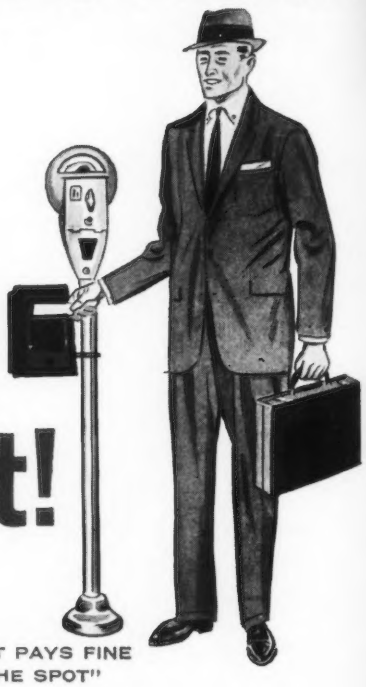
DUNCAN FINE-O-METER

After installation . . . cities report up to 80% of all parking fines collected are paid "on the spot" in DUNCAN FINE-O-METER boxes.

This effective, convenient system eliminates *embarrassing* trips to the police station thereby increasing voluntary payment without complaint. Also, *reduces* the number of tourist violators leaving city without paying fine.

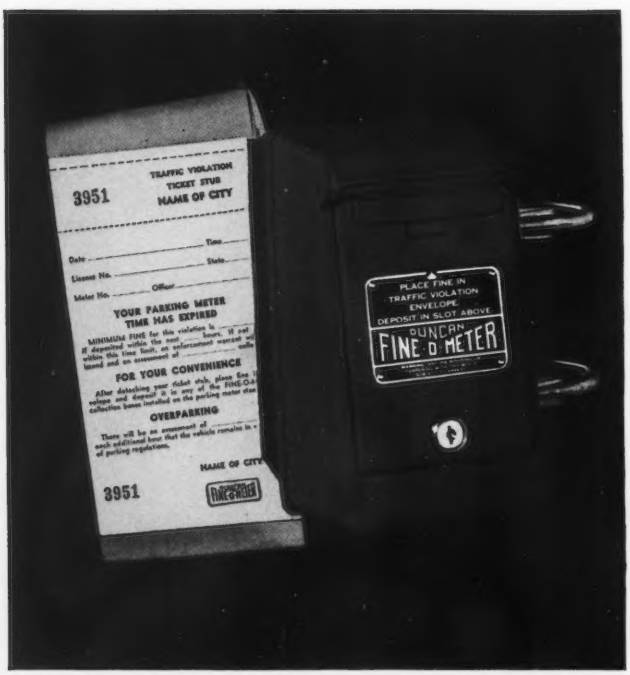
Weather-proofed violation ticket-envelopes used with the DUNCAN FINE-O-METER are readily available at low quantity prices. New "heavy-duty" ticket envelopes, especially prepared to withstand long periods of exposure to extreme moisture now available for prompt shipment.

For good public relations . . . investigate DUNCAN'S convenient system of traffic fine collection.



MOTORIST PAYS FINE "ON THE SPOT"

ea$y...convenient!



OFFICER ISSUES TICKET-ENVELOPE

EASY TO COLLECT

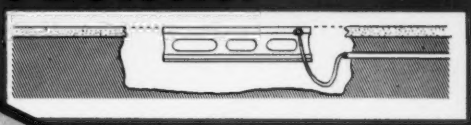
DUNCAN PARKING METER

A Division of NAUTEC Corporation

CHICAGO 22, ILLINOIS

Your actuated controller is as good as its detector, specify the best . . .

. . . Traffic Signals, inc. actuated controllers with the exclusive Surface Mounted Magnetic Detector



Model 242 Surface-Mounted Magnetic Detector

featuring:

- ✓Single Lane Detection
- ✓High Sensitivity with Sharp Cut-Off
- ✓Dependable over wide speed range
- ✓Completely sealed, moisture-proof cast aluminum unit
- ✓Does not wear out—Lasts for years—Street can be resurfaced over detector.

Used with the Multi-Purpose 102A Controller

Model 102A

Semi-actuated. Volume Density if desired.

Model 102A

Full-actuated. Volume Density if desired.

Traffic Signals, inc. also manufactures a sub-surface magnetic detector and directional or non-directional pressure detectors.

TRAFFIC SIGNALS		TRAFFIC SIGNAL CONTROLS	
Adjustable	Beacons	Pretimed Controls—Isolated or Interconnected	School Crossing Controls
Fixed Face	Downlite Beacons	Actuated Controls—Semi-Full-Volume Density	Master Controls, Console type
Lane Control	School Signals	Pressure Detectors—Directional, Non-Directional	Flashing Controls
Pedestrian Signals	Barricade Systems	Magnetic Detectors—Surface, Sub-surface	Pedestals—Signals, Controls

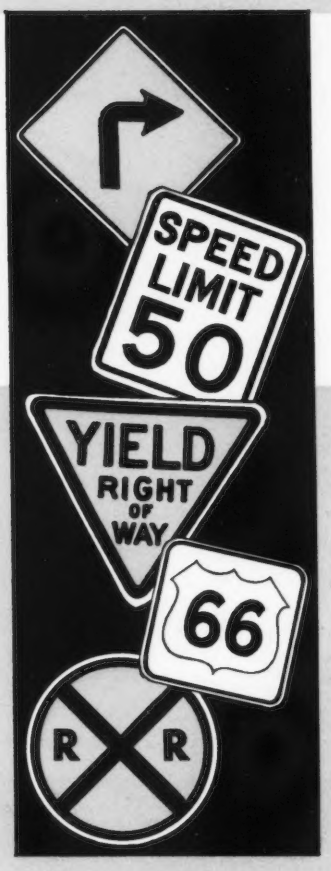
Traffic Signals, inc.

ADVANCED ENGINEERING IN TRAFFIC SIGNALS AND TRAFFIC SIGNAL CONTROLS

P. O. BOX 1303 • 222 BEACH STREET • SHREVEPORT, LOUISIANA

Stormcote®

maintenance program proves . . . FLEX-O-LITE Best...



Weatherometer and Fadometer tests demonstrate Extra Life and Reflectivity of FLEX-O-LITE SYSTEM

"Permanized" with amazing new STORMCOTE® protective coating, FLEX-O-LITE Reflectorized Signs reveal a life expectancy of five or more years with effective day and night brilliance and reflectivity under varying weather conditions, confirmed in authenticated weather-ometer and fadometer tests (note illustration).

STORMCOTE® adds years of useful service to the normal life expectancy of signs . . . assures maximum weather, water, dirt, and wear resistance for greater economy and satisfaction, particularly when FLEX-O-LITE materials and our recommended processing system are employed.

Isn't this the kind of economical performance, safety factors and long life you want in your reflective traffic signs and markings? Wire, write or phone for complete details.

FLEX-O-LITE PRODUCTS

- **#831** LEAD-FREE High Index of Refraction Beads.
- **UB 68** LEAD-FREE Medium Index of Refraction Beads and Sign Kits.
- **Type H** Safety Spheres with ultra-high brilliance.
- **Traffic Beads** — Free-flowing, Moisture-Proof and Standard.
- **All-Weather Airport** Runway Beads.
- **Sign Bead Dispensers**—Automatic and Semi-Automatic types.
- **Traffic Bead Dispensers.**

FLEX-O-LITE MANUFACTURING CORP.

8301 FLEX-O-LITE DRIVE, ST. LOUIS 23, MO. • PARIS, TEXAS
FLEX-O-LITE OF CAN., LTD., P. O. BOX 216, ST. THOMAS, ONTARIO, CAN.

MAKERS OF DROP-ON, FREE-FLOWING, STANDARD, MILITARY, MOISTURE-PROOF, HIGH AND MEDIUM INDEX SIGN BEADS

TRAFFIC ENGINEERING

OFFICIAL PUBLICATION OF THE INSTITUTE OF TRAFFIC ENGINEERS

Vol. 31 JULY, 1961 No. 10

INSTITUTE OFFICERS

A. F. MALO
President

GORDON K. GRAVELLE
Vice-President

ROBERT A. BURCH
Vice-President

J. AL HEAD
Secretary-Treasurer

DIRECTORS

A. L. HUTCHISON
District Number 6

FRED W. HURD
District Number 1

FENTON G. JORDAN
District Number 5

O. K. NORMANN
District Number 2

EVAN E. OLMSTEAD
District Number 4

HERBERT B. WOODLING
District Number 3

EDWARD G. WETZEL
Immediate Past President

PUBLICATION STAFF

DAVID M. BALDWIN
Editor

REBEKAH FRIEBELY
Managing Editor

PHYLLIS WILKINSON
Advertising Manager

G. A. BACCHUS
J. W. CHAMBLISS
C. C. CLARK
WM. E. CORGILL
R. E. DUNN
M. J. HUBER
E. A. MUELLER
C. C. ROBINSON
S. T. SIEGEL
BURT WHEDON
Associate Editors

CONTENTS

FEATURES

Washington—Your Capitol City 11
Bill Talbott

Vehicle Detection for Traffic Analysis and Control 14
Richard C. Hopkins

The History of an Idea on the Spacing of Vehicles On the Highway 17
Bruce D. Greenshields

Emergency Vehicle Control 19
Donald P. Ingold & Royce G. McCombs

NEWS

Traffic News 26
Coming Events 33
New Appointments 34
New Publications 36
New Equipment and Methods 37

TECHNICAL NOTES

An Informational Report on Speed Zoning 39

INSTITUTE AFFAIRS

World Traffic Engineering Conference—Study Tour by Bus 24
Technical Council News 45
Yearbook Changes 48
Membership Applications 50
Section News 49

HIGHWAY RESEARCH BOARD NOTES 49

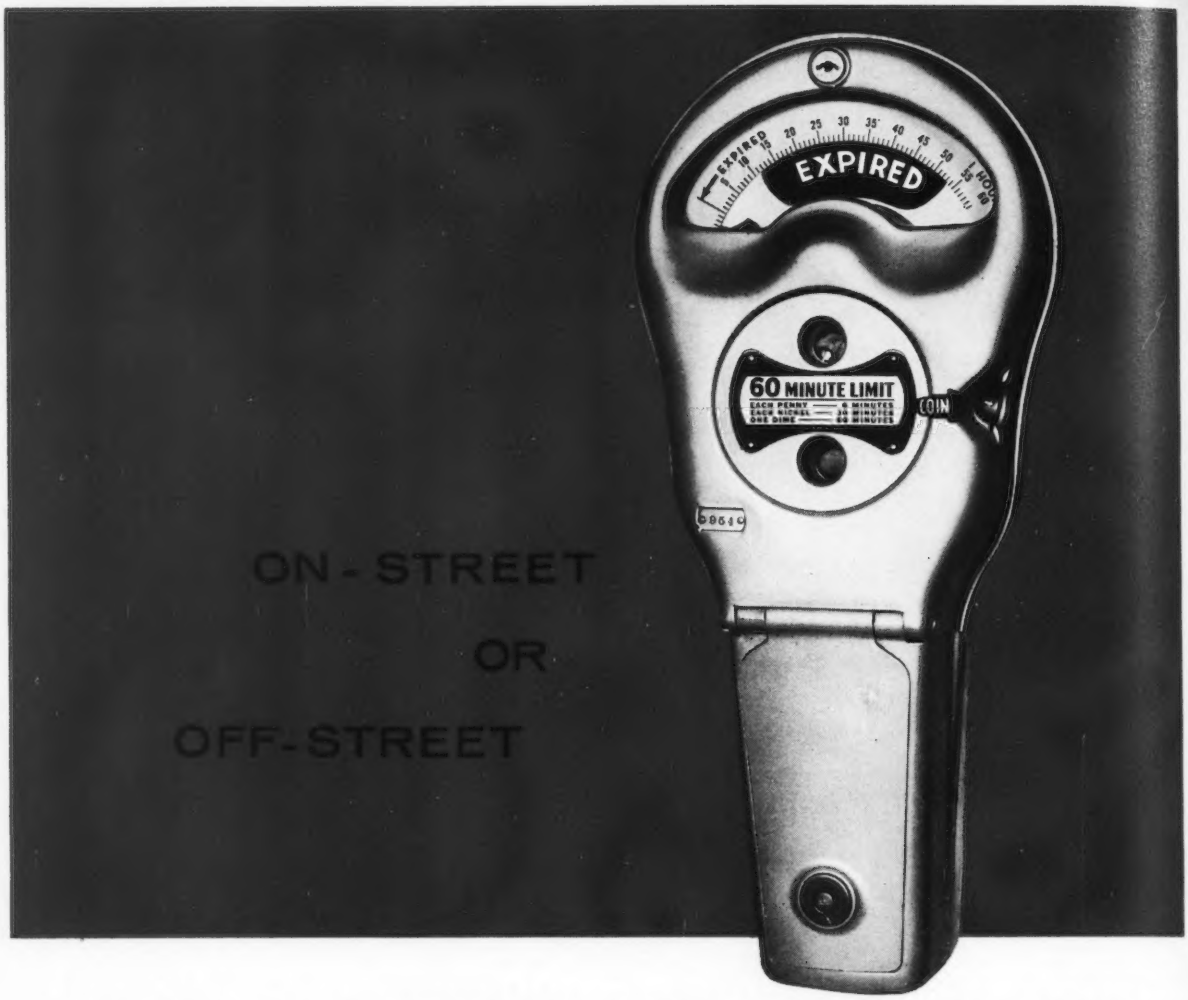
MISCELLANEOUS

Participating Organizations 45
Positions Available 45
Index to Advertisers 52
Professional Service Directory ..... 52 & 53

Cover: Lincoln Memorial and Memorial Bridge (lower left) across the Potomac River at Washington, D. C. At the upper left is visible the new building of the U. S. Department of State, site of the International Sessions at the World Traffic Engineering Conference.
—Photo from the D. C. Department of Highways and Traffic

TRAFFIC ENGINEERING is published monthly by the Institute of Traffic Engineers. Editorial offices are at 2029 K Street NW, Washington 6, D.C. Advertising plates should be sent to Interstate Printing Corp., 400 Watchung Avenue, Plainfield, N. J. Printed in U.S.A. Second class postage paid at Plainfield, New Jersey. ¶Single copies 50 cents, subscription price $4.50 per year in the United States and Canada; $5.75 per year to foreign countries.

The Institute is not responsible for any statements made or opinions expressed in its publications. Publication of advertising does not constitute Institute approval or endorsement of the products or services advertised. Permission to reprint contents with customary credit line is given unless otherwise stated. The Institute seal, pictured at the upper left on this page, is a Registered Trade Mark of the Institute of Traffic Engineers.



PARK-O-METER PRODUCES PROFIT

Whether your city has on-street or off-street parking problems, Park-O-Meter can be utilized to produce profits.

Park-O-Meters are automatic and accurate. They can be adjusted *on the site* for time, rate and coin changes, thereby eliminating costly shop maintenance and overhead.

Park-O-Meter parts are precisely engineered and skillfully built of finest quality brass, copper and stainless steel. They pay for themselves quickly and continuously. Let a Park-O-Meter parking expert show you how you can have a profitable parking meter system.

CLIP THIS COUPON

_____I would like to have more information.

_____Please have a Park-O-Meter representative call.

Name_____Title_____

City _____

State _____

P O M

MAGEE-HALE PARK-O-METER COMPANY

3909 Willow Springs Road • Oklahoma City, Oklahoma

Frankly Speaking . . .

NEW IDEAS HAVE POWER. They unlock and stimulate the mind, They broaden one's outlook. They can lead to new breakthroughs in dealing with complex problems.

To serve his state and local community and his times most effectively, the traffic engineer must have ideas for dealing with the complexities of dynamic growth, rapid urbanization, large increases in pedestrian and vehicular traffic, and changes in both rural and urban ways of living. The traffic engineer must do his regular work well, but he should also be recognized as one who has sound ideas for the future and who provides leadership.

Progressive professional specialists get ideas in many ways. One of the best ways is by discussion with outstanding leaders in their profession and in related fields. Especially stimulating are ideas developed by keen minds, and evolved from considerably different environments.

This August, an unique opportunity to benefit from the ideas of others will be afforded traffic engineers in the World Traffic Engineering Conference—Washington, D. C., August 21-26.

The first three days of the Conference will be the 31st Annual Meeting of the Institute of Traffic Engineers—with a carefully-planned technical program.

The three remaining Conference days, devoted to International Sessions in Traffic Engineering, deserve special consideration. Outstanding specialists from throughout the world will present new and challenging ideas in a truly star-studded program. *In many important areas, there is much that U. S. A. engineers can learn from them.* The very fact that they approach some problems from different viewpoints will prove stimulating. They have severe traffic and community-development problems. Indeed, I was much impressed when in England a year or so ago, to find that they had 37% more vehicles per mile of road than we had! IN other countries, too, I have observed serious problems and have seen many evidences of keen minds being applied to highway traffic needs.

Worthy of your attention also is a different METHOD of conducting a technical session which will be used during the International Sessions. This method may appeal to you for application in your own professional activities.

A new development is the addition of German as one of the International Sessions languages, so that there will be simultaneous interpretation in French, Spanish, German, and English.

"You will be there" when history is being made—for it is certain that this World Traffic Engineering Conference will be the first of others in which the Institute and U. S. traffic engineers will participate—*because of the values which are inherent in continuation of international exchange of ideas.*

The field study tour by bus in the week following the Conference has been carefully planned to be of practical value and to provide professional stimulation to engineers, both from overseas and from the U.S.A.

The Inter-American Traffic Seminar, September 4-8, Washington, D. C., is being sponsored by the Organization of American States—Pan American Union. Its program has been formulated with due consideration of the program of the World Traffic Engineering Conference—to complement without repetition, since it is expected that traffic specialists from the countries of the Americas will also attend the World Traffic Engineering Conference. While there will be official delegates to this Seminar, all interested traffic specialists are welcome to attend.

It is sincerely believed that an idea-studded, professionally enriching and challenging program is being offered—and is beckoning your full participation.

BURTON W. MARSH,
Chairman, Local Planning Committee,
World Traffic Engineering Conference

Catatherm Reflective Thermoplastic Striping adds safety and cuts maintenance cost on heavily traveled interstate highways

Cleanly extruded Catatherm hits and bonds to pavement at approximately 400°F. Stripe is traffic-ready 5 to 8 minutes later.

Maintenance costs on Interstate and primary State roads are sky-rocketing to the point they are now a main concern of all forward-looking and conscientious highway engineers and officials.

Catatherm adds longer life and reduces costs to highway striping. Catatherm is out of the ordinary. It outlasts the best quality paint from 9 to 26 times. That's Catatherm! The "Safety Stripe you can put down and forget." Note the edge stripe (above). Catatherm also, of course!

What makes Catatherm a better, long-lasting stripe? First, it is composed of specially formulated thermoplastic resins—a formula developed and tested through many years and on many miles of highway. Second, it is applied *hot* (400°F+) to assure positive bond with the road surface.

The finest components available assure the right pigmentation, and Cataphote waterproof drop-on traffic beads, applied simultaneously with the extruding operation, assure immediate all-weather reflectance—and long life.

Cut down on traffic risks by eliminating long traffic tie-ups—(Catatherm hardens in 5 to 8 minutes)—and by the elimination of continual restriping.

Give heavily traveled highways this clean, bright stripe by day and that real feeling of security that comes with the guidance of a brilliant stripe by night.

Can you afford to overlook the progress other engineers are making with the use of Catatherm, in reducing maintenance costs and increasing safety?

There is a catalog which will interest you—C-160—yours on request, ask for it.

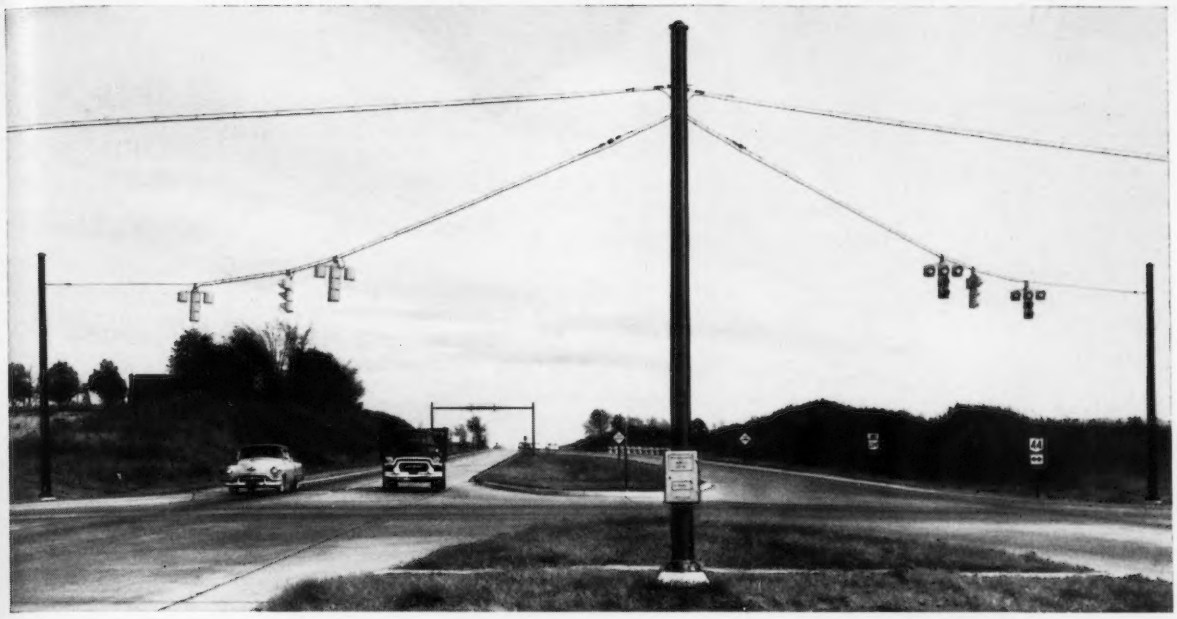
CATAPHOTE CORPORATION

161

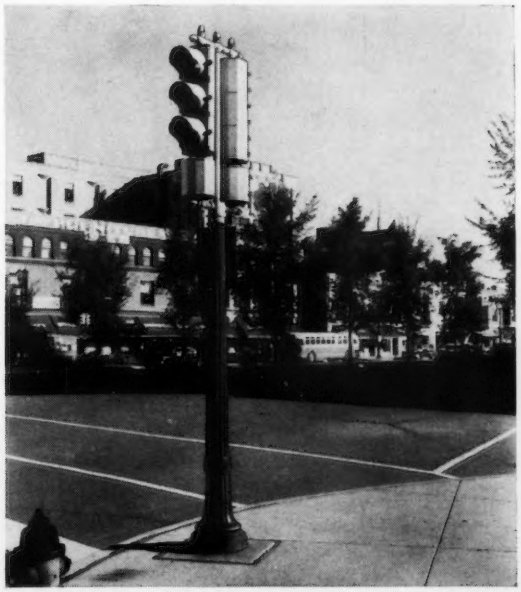
TOLEDO 10, OHIO / JACKSON, MISSISSIPPI

In Canada: CATAPHOTE/CANADA LTD. • P.O. Box 727 • Brantford, Ontario

MANUFACTURERS OF REFLECTIVE TRAFFIC PRODUCTS



UNION METAL'S unmatched experience is readily available to help solve your signal support problems



UNION METAL
Traffic Signal Poles
CANTON 5, OHIO — BRAMPTON, ONTARIO, CANADA

Steel or aluminum, plain round or fluted, Union Metal's broad range of traffic signal pole designs are long on economy and short on maintenance.

BLISS

one source one responsibility

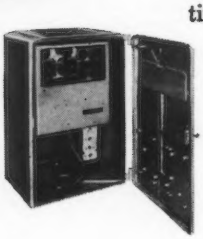
For All Traffic Control Needs

Pretimed & Actuated Systems

The "EC" Traffic Adjusted System

A practical ultra-modern computer program system capable of automatic control in highly concentrated grids or on heavily travelled key arteries. The central office master is custom-designed from standard plug-in chasses to meet the exact need of your application. Easily expanded to meet any future requirements. Works equally well with pretimed or actuated local control.

Eagle Bulletin E50



The EC LOCAL CONTROLLER is used with the EC Master. Has a *minimum* of 224 traffic function combinations built-in for selection from the Master panel.

Eagle Bulletin E50

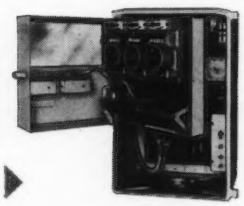
The Monotrol System . . .

Monotrol is a two-wire system of interconnection. Thirty-one functions may be transmitted over one circuit to give traffic movement flexibility at the intersections. Master is built to your specifications in accordance with functions desired. The Monotrol System adapts itself well to any pretimed local controller having a selection of splits and offsets from which to choose.

Eagle Bulletin E40

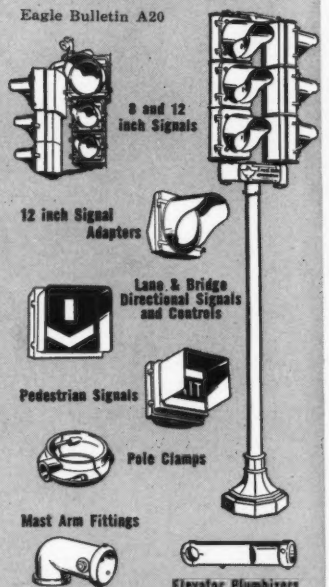
EF20 MULTIDIAL LOCAL CONTROLLER may be applied as single dial isolated intersection controller or built-into an expansible multidial triple reset interconnected system. Perfect for use with Monotrol System.

Eagle Bulletin E20



A COMPLETE LINE OF SIGNALS AND ACCESSORIES

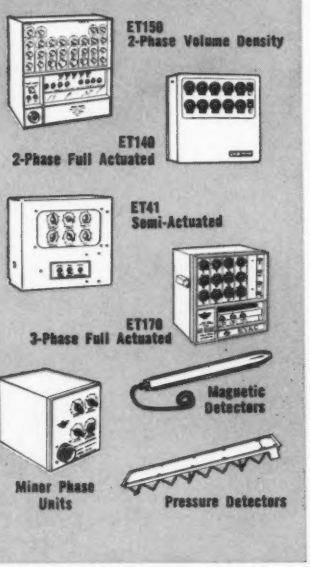
Eagle Bulletin A20



Complete Accessories for Every Actuated Movement and Application

A COMPLETE LINE OF ACTUATED CONTROLLERS AND ACCESSORIES

Eagle Bulletin F10



Plus ***• A thirty-five year background of sound experience***

- ***A strong research and development program***
- ***Application Engineers always ready to serve you without obligation***
- ***A crew of engineers ready to adapt your needs to specially designed control equipment***
- ***Sales Engineers in all principal cities to offer you immediate attention***

BLISS

EAGLE SIGNAL COMPANY, Moline, Illinois

A Division of the Gamewell Company
An E. W. Bliss Company Subsidiary

Eagle Equipment Saves Lives — Saves Time

THE EAGLE SIGNAL COMPANY
Dept. TE-761, Moline, Illinois

Forward Bulletin No. _____

☐ Have Sales Engineer Call _____

NAME AND TITLE

ORGANIZATION

FULL ADDRESS

Washington - - Your Capitol City

By Bill Talbott

IT IS SAID that every foreign visitor to the United States finds something from his homeland in Washington.

Even the casual observer in the cosmopolitan capital will quickly be aware of this adage when he glimpses the majestic foreign embassies dominating two of the city's principal thoroughfares, Massachusetts Avenue and Sixteenth Street.

There are more than 100 of them in Washington, each considered foreign territory under the laws of diplomatic immunity. A visitor from abroad may go to his country's embassy with its rich native appointments and use but little imagination to sense that he is in his homeland again.

But the foreign influence in Washington extends far beyond the diplomatic scene to mark the architectural style of many government and privately-owned buildings throughout the city, creating a stately metropolis with a charm, character and soul all its own.

If any one man could be called the architect of Washington, the title would go to Maj. Pierre Charles L'Enfant, the young French engineer employed by Gen. George Washington to design the city more than 150 years ago.

Inspired by the beauty of Paris, Maj. L'Enfant planned the Federal city with broad, tree-lined boulevards. He used circles liberally, both for their beauty and as sites for fortifications in case of attack, and radiated from the circles broad avenues extending throughout the city.

Although many of his ideas were discarded in later years, much of his original planning prevails. Possibly his most effective mark upon the city is the Mall, which extends from the Lincoln Memorial to the Capitol.

You can walk the whole distance in 50 minutes and see during the venture the heart of the Federal City.

The Capitol stands majestic at the east end of the Mall as a symbol of Democracy throughout the world. The Senate wing is on the left and the House of Representatives on the right. From here the visitor can take short walks to five other major tourist attractions: the Supreme Court, the Library of Congress, the Folger Shakespeare Library and the House and Senate Office Buildings.

Starting with the Memorial on the banks of the Potomac, a beautiful but polluted river, the visitor sees a $2 million structure dedicated to the memory of Abraham Lincoln, the country's 16th President. A 21-foot statue of Lincoln, seated, is surrounded by 36 marble columns, one for each state in the union at the time of his death, and is approached by 56 steps, one for each year of his life.

Passing along the reflecting pool, the visitor approaches the Washington Monument, a 555-foot Egyptian obelisk and the city's most prominent landmark.

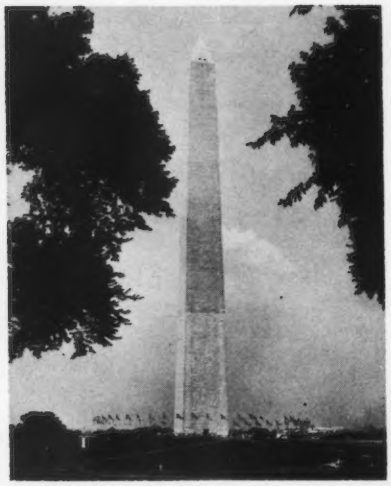
The full glory of Washington can be best appreciated from the top of the monument where the visitor can see the Medieval Gothic architecture of the Washington Cathedral, the Byzantine and Romanesque style of the National Shrine of the Immaculate Conception and the Islamic Center with its minarets characteristic of the Far East.

To the north is the White House which was renovated about 10 years ago at a cost of nearly $6 million.

To the south lies the Tidal Basin with its border of cherry trees, a gift from Japan. The large circular memorial, also to the south, honors Thomas Jefferson, who drafted the Declaration of Independence and became the country's third President.

The memorials are done in classic style, but as the visitor continues on the mall he discovers the Triangle Buildings along Constitution Avenue which have been characterized as Italian palaces.

The Smithsonian Institution with



The Washington Monument, the city's most prominent landmark and the best spot for a view encompassing the city and its environs, stands in the center of the Mall. Started in 1848, the structure stood incomplete for almost 25 years after it became involved in a political quarrel. The marble used after construction resumed was weathered to a slightly different tone, thus accounting for the line at about 153 feet from the ground.

This sweep of the Mall from the Potomac River in the foreground is dominated by the Lincoln Memorial, the Washington Monument and the Capitol with the sprawling Federal City on beyond. On the bank of the Potomac is the barge used for evening band concerts during summer months.

its towers and detailed ornamentation is Victorian in style, and the National Gallery of Art is a revision of classic Grecian Influence.

At the end of the walk lies the Capitol, the city's dominating symbol of Democracy.

In other parts of the city the visitor can find the Pan American Union with its South American decor, the Department of Interior and the new State Department, both excellent examples of modern functional design. The Department of Defense is housed in the world's largest office building, the Pentagon, where more than 40,000 persons are employed.

Government employees are Washington's sustaining force. Each morning of the work week they drive into the city by the thousands from sprawling suburbs in the adjacent states of Maryland and Virginia. Each evening the tide of automobiles is reversed as they head homeward for a few hours of respite before taking up the business of government again.

Although Washington is a transient city, with political and military personnel moving in and out, the majority of the 2 million people living in the vast metropolitan area have found stability in Washington after moving from other sections of the country and becoming entranced by the fast pace swirling around the center of events which reverberate throughout the world. Thus the native Washingtonian has become a rare creature, almost completely absorbed by newcomers and the more than 7 million visitors who come to gaze each year.

Washington holds on to its past with many historic shrines, 708 parks and 95 statues and memorials.

But this adherence to history has failed to hold change in check. The tremendous influx of population in the wake of World War II and the development of diversified industries and shopping centers in outlying suburban areas have presented municipal growth problems undreamed of a mere 10 years ago.

The Congress of the United States, which governs the city, and the three commissioners appointed by the President to administer the laws search steadily for solutions for problems re-

This view of the Jefferson Memorial at the edge of the Tidal Basin includes the White House at the end of the greensward immediately behind the memorial and the Washington Monument to the right. The memorial reflects the classic style Jefferson used in designing the rotunda of the University of Virginia and his home, Monticello, in Charlottesville, Virginia.

sulting from this rapid growth.

A Redevelopment Land Agency has cleared 580 acres of dilapidated homes in the city's southwest section to make way for a rebuilding of the area with private capital.

New freeways are constantly under construction to accommodate the constantly increasing flow of traffic, and new bridges are crossing the Potomac for better access to the Virginia suburbs and the Nation's Southland.

A National Cultural Center is planned for construction near the Lincoln Memorial. The 9,800-acre Dulles International Airport will open soon to handle jet traffic from throughout the world.

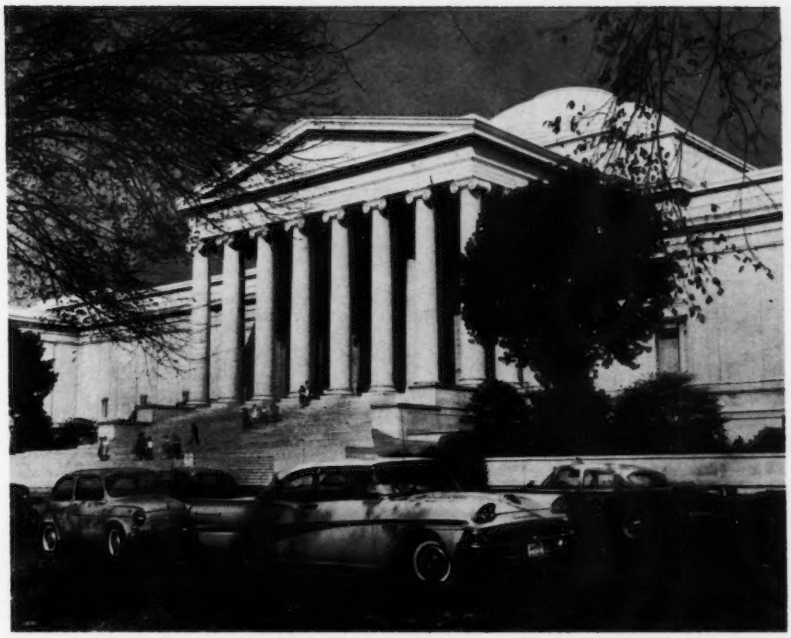
But Washingtonians have come to accept these innovations as commonplace, for what else would be expected in one of the cleanest and most modern cities in the world—frequently described as the bridge between the old and the new.

When off the job Washingtonians are more concerned with having a good time and they invite visitors to join in.

Here are a few events and places you might find of interest:

- Watergate Concerts at 8:30 p.m. on Tuesday, Thursday, Friday and Sunday nights at the Lincoln Memorial.
- Carter Barron Amphitheatre, Sixteenth Street and Colorado Avenue, N. W., "Carousel" starring John Raitt, 8:30 p.m., August 21-27.
- Voice of America Tours, featuring live broadcasts around the world in 36 languages, 11 a.m. and 3 p.m. Monday through Friday, second floor of the Health, Education and Welfare Building, 330 Independence Avenue, N. W.
- IBM Space Computing Center, providing vivid presentations of the United States' space programs, 615 Pennsylvania Avenue, N. W.
- Rowing events of the President's Cup Regatta, August 20, Hains Point.
- Baseball, Washington Senators vs. Baltimore, August 20; Senators vs. Detroit, August 25, 26, 27; Griffith Stadium, Seventh Street and Florida Avenue, N. W.

As can be seen, there will be much to do in Washington for both adults and the children. Plan to bring the whole family and take advantage of the hotel's low August rates, including accommodations for children 14 and under in your room *at no charge*.



The collections in the National Gallery of Art on the edge of the Mall represent European and American painting, Italian and French sculpture, European decorative arts, Chinese porcelains and Renaissance bronzes. The gallery also contains a collection of engravings, etchings, woodcuts, lithographs and drawings.

One of the newest and most popular statues in Washington is the Iwo Jima Memorial on the Virginia bank of the Potomac River. Cast in bronze, it depicts the actual flag raising on the island of Iwo Jima in the South Pacific by a group of Marines after bitter fighting during World War II.

Safety-FIRST
SLOW
SCHOOL
SAFE-T-CONE
TRAFFIC GUIDES
Use SAFE-T-CONES wherever traffic is difficult. Proven and accepted by Federal, State and Municipal traffic authorities in hundreds of major cities.
All-rubber SAFE-T-CONES available in 3 sizes . . .
28-inch
18-inch
12-inch
Solid-color PVC Poly-Cones available in 18-inch and 28-inch sizes.
SLOW
Because of their handling-ease, SAFE-T-CONES are easily adaptable to all situations at a moment's notice. SAFE-T-CONES command attention. All-rubber cones can be painted or reflectorized.
For full information write
RADIATOR SPECIALTY CO., CHARLOTTE, N. C.

Vehicle Detection for Traffic Analysis and Control

By Richard C. Hopkins
Chief, Instrumentation Branch,
Traffic Operations Division
U. S. Bureau of Public Roads
Westport, Connecticut

To apply a little of the space age terminology to a terrestrial problem, we are faced with a challenge to produce the fourth generation vehicle detector immediately.

Two human generations ago little concern was given to the counting of automobiles. Even after 30 years of rapid development to a total registration of 26¾ million vehicles in 1930, periodic manual counts and leisurely traffic studies supplied a few traffic and planning engineers with all the data that were then necessary.

The second generation vehicle detector was born as an offspring of man's natural laziness. The rubber tube and electric counter were pressed into service to free planning personnel from the tedium of vehicle counting. And, soon afterwards, the printing recorder saved the nuisance of frequently reading the accumulator.

Advances in photoelectricity and the desire for a vehicle detector which would not deteriorate from actuation by the vehicles being counted fathered the third generation of vehicle detectors; so that, before 1940, with its 32½ million vehicles, the so called present techniques of traffic counting were well established. In the last 20 years, great improvements have been made in the sensing devices used for vehicle detectors. The new mediums of radar, ultra-sonics, infrared, and electro-magnetism have been added to photoelectricity; but the basic devices, and many of the old limitations, still exist.

Since the late 1930's, the necessities of traffic analysis in studies involving structural design, geometrics, traffic control, highway capacity, and driver behavior have prompted the development of several special detectors peculiar to the needs of research and planning. Among these are the speedmeter, placement detector, and electronic scale.

The speedmeter, best known of the research group, is available in several different designs and price ranges. Each has its special advantages and all have been more highly publicized by the enforcement agencies than by traffic engineers.

Simplest of this group is the manually operated stop watch used in conjunction with a marked pavement. The "Enoscope," a mirror device which enables an observer to watch two markings usually 176 feet apart at the same time, eliminates the possibilities of parallax errors between the vehicle and the pavement markings. At least one company has produced a solenoid operated stop watch with which the pavement markings are replaced by road tubes and air switches. In any event, such a device is useful only for very light traffic conditions.

Electrical or electronic timing increases the usefulness of road tube detection by reducing the separation requirement. In contrast with stop watch timing, distance as short as two or three feet between paired detectors then may be used with negligible speed detection errors. The more rapid speed measurements of these systems also make it feasible for simple instrumentation to monitor more than one lane. However, the short-lived nature of pavement installed vehicle detectors limits the use of these speedmeters to traffic research and law enforcement.

The measurement of vehicle placement has been, to this point, principally useful to the traffic researcher and design engineer. The measurement is usually made by use of a segmented contact strip which determines the location of a vehicle's wheels in respect to a lane reference line. However, the bulk of such contact strips even limits their use for traffic research, and several projects are currently seeking to develop a new and more practical placement detector. Again the surface type of detector precludes the possible application of contact strips for continuously collecting instantaneous vehicle placement data.

Some weight data are being collected automatically by electronic scales. However, because of the many operational limitations of such present scales, almost all research data are collected from loadmeter studies and, except for toll gate weight grouping, little other use is being made of this equipment.

Research data on speed, placement, and vehicle classification are also automatically collected by photography. But, because of the natural complexities of the required manual data reduction, this medium will probably continue to be used for special detailed studies only.

In retrospect then, we have highly developed instruments and techniques for traffic research. We have a fine knowledge of the capacities of highways, streets, and intersections. Driver behavior studies have prompted human factors research to provide a better understanding of the intangible problems of traffic control. And we are able to forecast, with reasonable accuracy, needs, volumes, and areas of congestion. But, until very recently, actual traffic control has been by timed cycles, determined from selected field data, and preset for average conditions.

About two years ago a prototype traffic monitor was exhibited and its possibilities for automatic traffic control carefully demonstrated. This equipment used electronic computer

An address at the Joint Meeting of the New England Section and New York Metropolitan Section of ITE, Westport, Connecticut, April 27, 1961.

circuits especially adapted to the instantaneous reduction of a continuous input of vehicular traffic data. The units of the monitor were so designed that they could be interconnected, simply or extensively, in many combinations to record traffic data or provide signal control output as a function of one or several factors. Also, during the last few years much research and development has been undertaken in the field of traffic simulation. While this research is far from complete, and infallible programs are still an objective, both analog and digital computers have been used to provide graphic or illustrative outputs of traffic control problems in addition to the human factors research that has been accomplished with mock up automobiles and pictorial highways. This specialized computer research has provided for the adaptation of the highly perfected electronic computers to the solutions of traffic problems. Central traffic control computers, therefore, are immediately available to any traffic control area which will plan to make full use of such instrumentation.

At this point it might be well to compare automatic VEHICLE CONTROL with electronic computer TRAFFIC CONTROL so that one system or the other may be proposed for a particular situation without the disturbing thought that the other system might be better.

The fundamental difference between vehicle control and traffic control is that in the former a part of the electronic control system is included in each vehicle to be controlled. To reach its maximum efficiency then, ALL vehicles in the automatically controlled area must be fully equipped to accept and respond to the control information. While various sensing systems including radar using radio, infrared, or ultra-sonic mediums have been proposed and tested in limited areas, the most promising of the presently known vehicle control systems appears to me to be the magnetic block highway.

This is a system which provides for a continuous string of electro-magnetic loops in each lane of a highway. Each loop senses the presence or absence of a vehicle and a time measurement between two consecutive loops can be converted to speed. The programming of the central computer, to which all loops are connected, provides for the number of unoccupied loops which must be left between any two vehicles in the same lane as a function of the speeds of the two vehicles involved. The "operator" of a vehicle may preset his desired top speed and the acceleration and braking control signals from the computer, as returned to the vehicle through the loops in the pavement, attempt to attain this speed with maximum safety. Steering the vehicle within a lane is accomplished by detectors on the vehicle sensing a signal cable in the center of the lane and tracking it. The "operator" may change lanes by taking manual control (and responsibility) of the vehicle and steering to an adjacent steering signal cable.

Automatic VEHICLE CONTROL then, as so far demonstrated, appears to be more adaptable to open highway use than to short headway urban area traffic, whether it be a city street or a multi-lane expressway. This is because of the high cost of locating a vehicle accurately. Maximum capacity demands that a vehicle be located within inches and, where definition is concerned, the fewer the allowable feet of error the greater the cost. When one is talking of continuous measurement of the location of each vehicle in inches, the system cost is beyond imagination. For instance, it might be determined that for close control a block could be no more than six inches long. The resulting 10,560 blocks per lane per mile would soon demand a central computer completely out of proportion to the derived benefits.

Interurban automatic vehicle control may, in the somewhat distant future, possibly be available for those who care to equip their vehicles for it. It is much more difficult to visualize urban vehicle control, except as a conveyor belt (street) system.

Computer TRAFFIC CONTROL, on the other hand, would make no attempt to accelerate, steer, or brake vehicles. These functions, plus the selection of route would be entrusted (as now) to the judgment of the vehicle operator. By a continuous sampling of volume, speed, headway, placement, and vehicle length, the central computer would operate traffic signals and, yet to be designed, information signs to expedite all traffic within the programmed area to the maximum capacity of the streets involved.

What sort of electronic city, then, might be devised by traffic engineers and praised by the public with a minimum of driver education on new concepts? Almost all of that which exists could be retained in its present and natural form. Normal good driving practices limiting weaving and bumper riding, and encouraging the use of turn signals, would prevail.

New in concept would be two basic requirements. All lanes of streets which would operate at, or near, capacity would be reversible in traffic direction and right and left turns would only be permitted from the respective curb lanes. Turns also would have to be made without waiting; that is, the block into which a vehicle proposed to turn should be capable of accepting another vehicle.

Let us then explore a possibility of computer traffic control using these minimum requirements and familiar signal devices to inform the drivers. A central computer suitably programmed would be connected to a detector in each lane of each block. Individual traffic lights would be required for each lane at each intersection, with perhaps midway red or green lights to remind drivers of the lane direction permitted at any particular time.

The initial condition, of course, would be with all streets equally divided by direction and by signal green time. Almost immediately the computer would be informed that some vehicles were being delayed by one or more signal cycles on a primary street when few if any vehicles were using the cross streets. At this point the computer could only accomplish that which a traffic engineer would have provided for in the first place—assign a much longer green period to the main street or place the cross street on some actuated basis.

With a steady increase in traffic to some peak hour, preset traffic signal cycles may provide for the average traffic shown on volume graphs. But, as average conditions seldom if ever exist, it becomes very necessary to continually adjust control devices to immediate conditions.

Detectors in each lane of each block can indicate the need for more lanes in one direction on a particular street than in the other. The computer can make an immediate decision as to which is the last car to be permitted to use a lane in the low demand direction; then, by control of the individual lane lights it can reverse a

lane by following that car, block by block. This process can be extended to making streets "one way" as necessary and for only such lengths as actually need the directional capacity. Thus, with proper detectors and a computer using programs now being developed in simulation research, optimum adjustments to promote traffic flow can be made continuously by a device which can scan the sensing units at the rate of a million detectors per second. All streets then can be utilized to full capacity and a maximum possible rate of flow promoted on each street.

The computer proposed for this central control system would not be a standard commercial product. Its physical size, electronic data capacity, and cost would be staggering at first thought. However, with the prospect of operating all parallel routes at capacity, the full use of existing and proposed streets should be more economical than the inefficient use of many more lanes of highways in these areas of highest land values.

An innovation in driving aids is a requisite for full use of computer traffic control. A new visual information device will need to be developed with follow-up driver education to promote its use. The device should indicate that, one block removed, parallel traffic is moving x miles per hour faster or slower than on the street used by any certain driver. Perhaps the device might also be enlarged to indicate how many blocks one way or another a driver would be required to move to realize a five (for example) mile an hour increase in his average speed. As this possibility is explored, other and more spectacular developments should certainly ensue.

With a first look then at urban computer traffic control, it appears that traffic engineers should now, with the counsel of electronic systems engineers, be planning integrated traffic control for each metropolitan area around a suitably programmed central computer. This planning step is possible, because the factors determining street and intersection capacities have been well established; and, as has just been pointed out, computers for any special operation can be assembled from existent hardware. Television surveillance research now being conducted, and other proposed intensified traffic studies, will provide the opportunity to prove laboratory developed computer programs and supply the additional data that may be needed for determining some constants. Techniques for the transmission of intelligence by cable and radio are at a high state of perfection and communications engineers should be confronted with no more than routine problems in providing for the computer input or traffic signal and information sign control.

The challenge then, is to be able to determine the factors which are so completely shrouded by the too familiar term "traffic". And, factors of this nature are, of course, determined by detectors. Somewhat earlier in this discourse, your attention was directed to the special detectors which were used in traffic research. Single detectors were used for each factor to be studied, and these data could be amplified by the advantages of manual recordings by observers. To be effective, any computer traffic control system must have a continuous input of complete volume, speed, headway, placement, and classification information for each city block in the controlled area.

Counting must be by vehicles. Any adjustment of axle counts to volume can only be an average which can easily vary at any period by groupings of passenger cars or large commercial vehicles. Individual speeds must be available so that the computer can sense trends. Headways, likewise, will provide the computer with invaluable data on impending "jams". Vehicle placement definitely affects the capacity of a street, and the effectiveness of a computer would be seriously hampered if it did not know the length of the vehicles with which it were dealing. For instance, six large trucks in a block could mean the difference between the block being at capacity rather than having space for twelve more passenger cars.

When the traffic monitor was introduced, traffic engineers were shown a perfected detector which would count vehicles and determine speeds with a single unit. Since that time a second type of detector has become available which has a dual output for speed and volume. The newer mediums of detection, radar, ultra-sonics infrared, and electromagnetism, have brought within the realm of probability the evolution of a new generation of vehicle detectors; units which will in one small package provide outputs for count, speed, separation (headway), placement, and classification.

With each lane of each block of any traffic control area monitored by such an ideal detector, a properly programmed central computer could control traffic signals and information signs so that all streets could operate with freely moving traffic up to capacity. Such a system is envisioned complete with individual lane control lights, all lanes reversible so that the computer can go to the extreme of calling for one way streets as occasions require, and information signs or indicators at each intersection to show the percentage of capacity of that street and the location of nearby streets with less congestion.

To the motorist, computer traffic control could give a freedom of choice of routes from information signs and traffic signal cycles on each street. To the traffic engineer, it offers the opportunity to operate each street up to capacity at any time rather than accept signal control by fixed cycles or average demands at local control points. To the manufacturers of detectors, it offers a tremendous challenge for accomplishment to produce an economical five purpose detector; allured, of course, by the prospects of supplying one or more detectors per lane per block for all urban areas.

This proposal may seem fantastic; but, it does offer the possibility for full utilization of our urban streets by means of an "all seeing eye" and an "infinite brain". The electronic computer and the communication techniques are immediately employable; a history of scientific developments in this country affords us hope that the five dimension detector is about to evolve.

WANTED

A Copy of the October 1954 issue of TRAFFIC QUARTERLY of the Eno Foundation. Needed for the ITE library at headquarters. If you have a copy which you will contribute, please write to:

Institute of Traffic Engineers
2029 K Street N.W.
Washington 6, D. C.

The History of an Idea - -

On the Spacing of Vehicles on the Highway

By Bruce D. Greenshields
Assistant Director
Transportation Institute
University of Michigan

THIS IS THE HISTORY of an idea. The idea has to do with the nature of the distribution of the time or distance headways between vehicles traveling at various speeds on the highway. In keeping with the history of all ideas, this one has led to new theories and hypotheses. The principal reason for writing this account is that all of these new hypotheses have not been tested by the observation and analyses of traffic behavior.

It is sometimes difficult to say just when an idea originates. It was about 1935, as a result of a study of highway capacity, that data was at hand that might enable one to find out something about how traffic distributes itself along a roadway and to determine, among other things, the point at which a driver approaching a slower moving vehicle starts to reduce his speed to keep from colliding with the vehicle ahead.

An analysis and study of the data resulted in a paper, "Initial Traffic Interference," which was presented at the annual meeting of the Highway Research Board, November 19, 1936. As the title indicates, this paper was a discussion of the point at which the density of a traffic stream causes it to reduce speed. This paper was not published in the Proceedings, but the title of the paper attracted the attention of W. F. Adams in England. Mr. Adams obtained a mimeographed copy of the paper and after reading it, wrote to point out that some of the graphs given in the paper represented "Poisson" random distributions.

The Poisson distribution has been found to characterize many traffic behavior patterns, including the frequency of accidents. This paper, however, is concerned with speed and spacing only. The nature of the distribution is shown in Figure 1.[1]

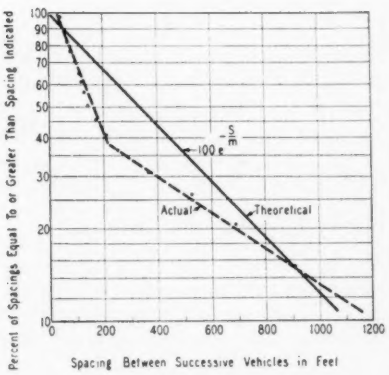


Figure 1
Cumulative Frequency Curve of Spacings between Successive Vehicles

The nature of the distribution of speeds and spacings is shown by the graph marked "Actual." This curve was plotted from data collected in Ohio in 1934.[2]

This cumulative frequency curve is drawn on semi-logarithmic paper. The graph consists apparently of two straight lines intersecting at about 200 feet. The graph on the right, designated as "Theoretical," will help explain the nature of the graph on the left. It is the area near the intersection of the straight line graphs that is of most interest. It is not logical to assume that the lines intersect at a point. A traffic flow pattern does not break that abruptly.

The equation of the theoretical curve is of the general form $y = e^x$ and hence is a straight line on semi-log paper. The Poisson distribution is of this form. To show this, let it be assumed that the probability of the occurrence of a time or distance gap of a given length between vehicles is the probability that no vehicle will appear in the given interval. This probability P(O) is equal to:

$$P(O) = e^{-m}\frac{m^O}{O!}$$

wherein m equals the arithmetic average. Since:

$$\frac{m^O}{O!} = \frac{1}{1} = 1, \quad \text{then } P(O) = e^{-m}.$$

For example, if the average spacing between vehicles is 450, then m, the average number of vehicles per 50-foot space, is $50/450 = 1/9$ and the probability of a space of 50 feet space having no vehicle is equal to:

$$P(O) = e^{-50/450} = e^{-1/9},$$

and the probability of a space of 100 feet having no vehicle is equal to:

$$P(O) = e^{-100/450} = e^{-2/9}.$$

In general, the probability of a space S having no vehicles is equal to:

$$P(O) = e^{-s/m}.$$

The equation of the graph shown is equal to $100e^{-s/m}$ since the origin is at 100%.

Discrepancies Between the Theoretical and the Actual Distributions

It is quite evident that the theoretical curve does not fit the data. If the observed results are compared with the theoretical curve, it is found that the deviations from the random distribution are accounted for by there being:

(a) No spacings below 30 feet,
(b) An excess of spacings between 30 and 200 feet, and
(c) A deficit of spacings in excess of 200 feet.

These discrepancies are logical since the minimum spacings, center to center of vehicles, are limited by the lengths of the vehicles and because vehicles closing up behind slower vehicles and waiting for an opportunity to pass, create a preponderance of the smaller spacings.

If it is assumed that there are two random distributions rather than one, the discrepancy disappears for, as indicated by the broken-line graph, the minimum spacing distribution is random (extending from about 30 feet

1. Bruce D. Greenshields and Frank M. Weida, **Statistics with Applications to Highway Traffic Analysis** (New York: Columbia University Press, 1952), 170.

2. Bruce D. Greenshields, "A Study of Traffic Capacity," **Proceedings**, Highway Research Board, XIV (1935), 448-476.

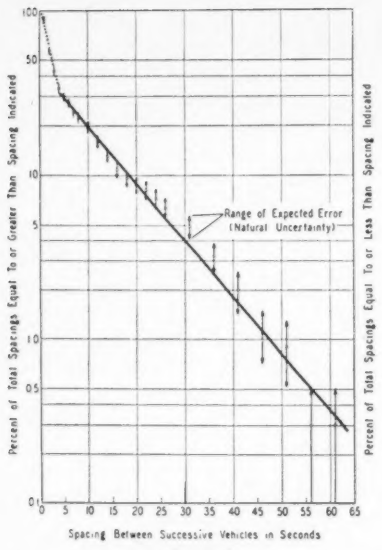

Percent of Total Spacings Equal To or Greater Than Spacing Indicated
Percent of Total Spacings Equal To or Less Than Spacing Indicated
Range of Expected Error (Natural Uncertainty)
100
50
10
5
1.0
0.5
0.1
0 5 10 15 20 25 30 35 40 45 50 55 60 65
Spacing Between Successive Vehicles in Seconds

Figure 2
Graph Showing Percentage of Vehicle Spacings and the Probable Amounts of the "Natural Uncertainty" of the Plotted Points

to 200 feet). Beyond about 200 feet, there is apparently another random distribution different from that below 200 feet. This may be interpreted to mean that the spacing distribution for less than 200 feet varies with the judgment and the perception-reaction time of the driver. Beyond 200 feet, the spacings may be judged to be in accordance with the chance placement of vehicles on the highway.

Figure 2[3] shows the time spacings between vehicles and the "natural uncertainty" of these spacings.

This graph shows that the time or distance spacings between vehicles are variable. They have a central tendency but their "natural uncertainty" is such that they must be treated as stochastic variables. Statistical analysis gives the assurance that the variability lies within certain limits.

Future of the "Idea"

Let us now re-examine the "idea" to see if any conjecture can be made as to its future history. The first thought that comes to mind is that the data on which the curves are based are out-of-date and probably not as accurate as could be desired, and that therefore new and more comprehensive data should be obtained.

The collection of such data is not too difficult. The data for the curves shown are collected by means of time-lapse pictures. For this method to be efficient, certain techniques are essential. These techniques have been developed over a period of several years and need not be described here. The cost is not excessive. In a study conducted in 1953, traffic data from aerial time-lapse pictures were transcribed on to 10,000 IBM cards and analyzed. The amount appropriated for the project was $8,000, which will give some idea of the difficulty involved. The Bureau of Public Roads *Traffic Analyzer* could be used to obtain the field data. It need not be described here for its use is well known.

It is not implied that obtaining field data is an easy task. It is difficult but certainly can be done. Having obtained the data, it would be interesting to know at what rates traffic streams form into queues and coalesce to a standstill and then disperse. These phenomena are called traffic shock waves. The speed with which these shock waves build up and then dissipate is not a constant, for each traffic stream is composed of vehicles with different characteristics and of drivers with widely varying driving habits.

Also, the speed with which a shock wave occurs depends on the space density of traffic. If vehicles are all at sparse chance random spacing, it will take considerable obstruction to free flow to cause a shock wave. If part of the stream has collected into queues, it will take less time. If the traffic density is such that all vehicles are traveling at minimum spacing in one long queue, then the stream is very sensitive to any obstruction and shock waves take place very suddenly.

It is believed that the nature of traffic shock waves can be determined only by observation. The observed behavior patterns must be analyzed by statistical methods. Such an analysis should make it possible to answer several interesting questions, other than those pertaining directly to the rates of the build-up and dissipation of traffic shock waves.

Dynamic Friction in a Traffic Stream

Consider the question of the nature of what might be called the dynamic friction in a traffic stream. If all the vehicles in a stream are moving at the same speed, there may be said to be no internal dynamic friction, for this friction may be defined as the sum of the squares of the speed differences between successive vehicles.

If the speed of one vehicle is V_1 and that of the following vehicle V_2, then the speed difference is $V_1 - V_2 = V$. If the rear vehicle is traveling faster, its speed must be reduced to that of the vehicle ahead to prevent a collision. A reduction of speed requires time and distance. The relationship between force, distance and energy is given by the formula found in any text on elementary mechanics: $F \times D = \frac{1}{2}mv^2$, in which F = force, D = distance, m = mass, and v = velocity in feet per second. In the stopping of a vehicle, the force F is that of friction. If two vehicles have equal masses and are moving at the same speed, they have the same energy of motion. If they have different speeds (velocities), they have different energies. In other words, if it is assumed that all vehicles have essentially equal masses, then the differences in energies are proportional to the differences of the squares of the speeds.

If the spacing between vehicles is sufficient, speed fluctuations in the traffic stream will be absorbed without affecting the forward movement of the stream. When the spacings become too small, the traffic stream is easily disrupted and quickly collects into a queue that travels at a uniform speed or grinds to a stop.

It may be assumed that a critical traffic condition exists when the ratio V^2/D reaches a certain value. This value is not a constant, but lies within a certain range. This range can be determined only by observing, recording, and analyzing the traffic behavior patterns. After analyses have been made, mathematical models may be fitted to the observed traffic flow patterns. Many mathematical models have been developed within the last few years—there is available a fairly long list of references. But a common characteristic of these models is that we do not know how well they fit. No matter how intriguing the mathematical model, it is of no practical use unless it is demonstrated that it fits the 'actuality.' For example, the equation '38-24-36' conjures a picture of an intriguing 'model.' But the possibility of finding an actuality to fit this equation is very remote indeed. As a 'design' equation, it would be worthless.

The fact that traffic flow research is still being conducted demonstrates that the fundamental problem of speed and spacing on the highway has not been satisfactorily solved. The prerequisite

(Continued on page 36)

3. Greenshields and Weida, op. cit., p. 167.

Emergency Vehicle Control

By Donald P. Ingold
Traffic Engineer
and
Royce G. McCombs
Assistant Traffic Engineer
Greensboro, North Carolina

THE CITY OF Greensboro, North Carolina has for many years used the "all-red" clearance provision in its signal system for aiding emergency vehicles through the central business district. As traffic volumes on city streets became greater, it was apparent that this method was not an efficient one. Unnecessary delay was experienced by vehicles not even in the vicinity of the route of the emergency vehicle and often times the "all-red" was in effect for several minutes, causing a breakdown in our signal progression system and reducing street capacities to almost nothing. It was imperative that another method be developed to cope with this problem.

In an attempt to gain the benefit of the knowledge and experience of other cities as to how they aid emergency vehicles through the CBD, a questionnaire was sent to sixteen cities throughout the southeast varying in size from populations of 40,000 to 1,200,000. Replies were received from all of these cities, summarized as follows:

Findings of the Survey

1. *Are emergency vehicles allowed to exceed the posted speed limits, If so, by what margin?*

Fourteen of the cities replying indicated that their city ordinances allowed all emergency vehicles to exceed the posted speed limits without any limit so long as they do not endanger life or property. One city imposed a 35 M.P.H. speed limit on City Fire Bureau ambulances, but these are the only vehicles to whom the restriction applies. Another allowed 10 M.P.H. above the posted speed limit with a maximum of 45 M.P.H.

Only one city did not allow any ambulances to exceed the posted speed limits; however, fire trucks and police cars were allowed to exceed the speed limits according to the discretion of the driver.

2. *Are emergency vehicles allowed to use sirens? Are there any restrictions on siren use as to time of day or areas of the city?*

All responding cities allowed the use of sirens on emergency vehicles, with the exception of one city where ambulances specifically were not permitted to use sirens at all, nor were they allowed to disregard any traffic control devices.

Two of the reporting cities indicated that the use of sirens was restricted in hospital zones, all others had no restrictions.

3. *Is there any provision in your signal system for movement of emergency vehicles through the central business area? If so, what type?*

Four cities provided for the movement of emergency vehicles through their central business area. One type allowed all traffic signals in central business districts to be placed on flashing red when an emergency vehicle was making a run. Another had all traffic signals in the central business district connected to the master controller and divided into five fire runs. Any one or any combination of these five groups could be controlled simultaneously from the switchboard at the Central Fire Station.

A third method used was a provision for flashing amber on Phase A and red on Phase B. This system was available to the city but had not yet been utilized.

Blinking caution lights and sirens on corner posts were utilized by one city. The operation of this system was controlled from the Central Fire Station and was used only by the fire department.

The remaining twelve cities had no provision in their signal system for the movement of emergency vehicles.

4. *Do you provide a special lane for movement of emergency vehicles through the central business area? If so, how are these lanes identified?*

This question was asked primarily to determine if a fire lane was provided in any instance. Of the sixteen answering cities, none provided a special lane for emergency vehicles.

5. *Are emergency vehicles allowed to disregard traffic control devices such as stop signs, yield signs, no left turn signs, etc.?*

Fifteen of the cities replying indicated that their city ordinances allowed all emergency vehicles to proceed past traffic control devices but only after slowing down as might be necessary for safe operation. All questionnaires answering "yes" implied that should an accident occur, the driver could be charged for negligence.

One of the sixteen reporting cities did not allow any emergency vehicle to disregard any type of traffic control device.

6. *In your opinion, is your present method of regulating the movement of emergency vehicles adequate?*

It was the opinion of most of the cities questioned that their present method of regulating the movement of emergency vehicles was adequate. This statement was borne out by fourteen answering "yes" to our question and two answering "no". However, it should be taken into consideration that a "yes" or "no" requirement might have forced an answer that did not give an entirely true picture. We are confident that many city officials will agree that parts of their ordinances for controlling emergency vehicles could be improved.

Emergency Vehicle Control In Greensboro

Operation of the "all-red" system is

difficult and the procedure necessary is quite inefficient.

When an emergency vehicle requests by radio that the lights be turned all-red, the radio operator will turn the lights all-red. The lights will be turned back to normal operation only after the emergency vehicle has reported back to the operator that he has either cleared the all-red district or has reached his destination if it is within the all-red district. The police radio operator will then notify all cars that the all-red is off.

If the officer at the Jefferson Square (Elm and Market Streets) determines through observation that there is a need for all-red clearance to assist any authorized emergency vehicle through the all-red district, he may turn the all-red clearance on and as soon as possible notify the radio operator of his action and why he turned them on. The radio operator will in turn notify all cars by radio. The all-red clearance is then not turned off until the operator learns from the officer at Jefferson Square or a police vehicle by radio that the emergency vehicle has cleared the all-red district. In the event that a police vehicle has been assigned to assist the emergency vehicle, the all-red lights will not be turned off until the police vehicle has also cleared.

As a result of the survey and a study of emergency vehicular movement in the central business district, three plans were presented to the Greensboro Transportation Committee for consideration.

Radio-Controlled System

There are two manufacturers of equipment that will provide emergency traffic control by radio. The traffic engineering department has made trial installations of both systems.

The radio-controlled system is made up of four basic components: transmitter, receiver, pre-emptor, and monitor light.

The transmitter is installed on the emergency vehicle. As the vehicle approaches the controlled intersection, the receiver detects the vehicle's presence and the direction from which it is coming. This information is sent to the pre-emptor which determines the direction to give the green light. The green light is assigned and an indicator beacon is turned on. After the vehicle has passed, the lights go back to normal operation.

The cost of the intersection equipment for a system to control 25 intersections would be approximately $20,000. The cost to equip the emergency vehicles would be approximately $400 per vehicle.

The equipment is still in the experimental stage and there is room for improvement in the reliability and uniformity of operation in the equipment which we have for test purposes. One of the problems is finding a place on the vehicle to mount the transmitter and radiating antenna. The unit must be mounted on the hood level or roof top to prevent degradation of operational reliability. Also, there is additional drain from the battery of the vehicle which should be considered.

This equipment would require considerable periodic maintenance to assure proper operation. The possibility of a component failure in this system is much greater than a system controlled by wire, therefore the reliability is not as good.

The radio-controlled system does not permit the responsibility of the operation of emergency traffic sequence to be placed on any one person. The driver of every emergency vehicle which is equipped properly can actuate the emergency traffic sequence.

One advantage of the radio-controlled system is that a minimum delay would be experienced by motorists in the central business area during the time that an emergency vehicle is making a trip through the central business area.

Green Band System

This system provides a means for aiding movement through the business area and will not necessarily provide a protected route to all areas in the central business district. The proposed system will provide a green band for a southbound emergency vehicle on Greene Street from Bellemeade Street to Edwards Place. A second provision will allow northbound movement from Edwards Place to Bishop Street. Eastbound and westbound emergency vehicles will have the green band from Davie Street to Eugene Street.

There are four combinations available for pre-emption by throwing one of four switches at one central location. The following combinations are: southbound run; northbound run; from north to east or west; from east or west to north.

In order for this system to be effectively operated, it is essential that there be only one control point, preferably at a centralized communications center or, second best, at the central fire station. Only one emergency vehicle or convoy of emergency vehicles can be given permission to use the green band at one time.

The estimated cost of this installation is $5,000. If this plan were to be adopted, there would be no provision for the movement of emergency vehicles in the CBD during the three-week installation period.

Flashing Signal System

This system is very similar to the "green band" system. The major difference between the flashing light plan and the "green band" type movement is that the latter provides for a definite assignment of right-of-way, while under the flashing light plan, the emergency vehicle would be shown a flashing amber light with the intersecting streets being given a flashing red light. Operators of emergency vehicles moving through the flashing system would be required to exercise more caution since the right-of-way assignment would not be as positive as in the "green band" type system. The flashing system has one definite advantage in that traffic stopped on intersecting streets would normally not experience as much delay as is created by the other systems. Under the flashing system, a person who stopped for the flashing red light could proceed through the intersection if it were safe to do so.

This plan would cost somewhat less than the "green band" type system if the caution pre-emptor is provided in the "green band" system.

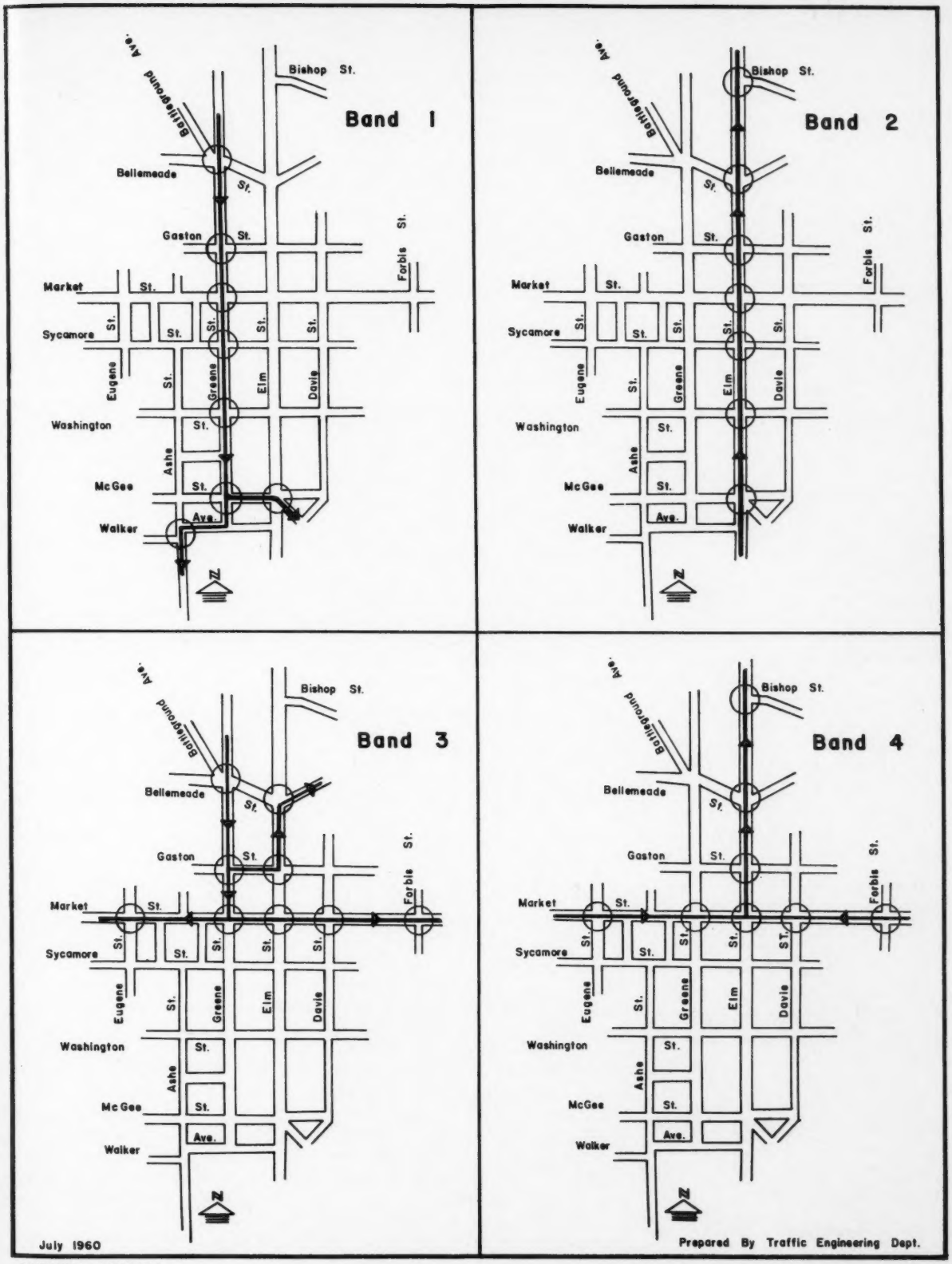
Selection of the Type of System

After careful study of the merits of the three systems, the "green band" system was chosen as the most practical, and plans were made for the change over.

An extensive public relations program was carried out by the traffic engineering department to inform the public as well as the users of the green band system how the system would function. Meetings were held with all ambulance operators, police department, fire department, and all other agencies concerned to discuss and draw up an operations procedure. As a result of these meetings, a plan was adopted.

Operational Plan Adopted

It is anticipated that the "green band" provision for emergency vehicles will provide a safer travel route



THE LITHO PRESS, INC., GREENSBORO, N. C.

for vehicles answering emergency calls than the present "all-red" system. This will also reduce the delay experienced by vehicle movement which would not conflict with emergency vehicle movement. The reduction in delay is of prime importance during the morning and afternoon peak traffic periods.

The procedure to obtain the proper "green band" clearance will have to be different from the procedure now followed to obtain "all-red" clearance. The changes will eliminate most of the guess work involved in the present system. If a vehicle making an emergency run is to obtain "green band" clearance, it must have radio contact with the fire department or its particular office. For example: the police patrol car has radio contact with the police radio operator, an ambulance has radio contact with its office, and the fire truck has radio contact with the fire radio operator. If this were not a requirement, the fire department would not have any way of knowing when the emergency vehicle has cleared the "green band" zone. Without this requirement the efficiency of the "green band" system would not be realized; in fact the delay of traffic would probably be more than it is with the present "all red" system.

The Greensboro Fire Department is the only control point for the "Green Band" system. The procedure to follow to obtain the "green band" clearance for the various services is as follows:

A. Fire Department:

1. The Fire Department receives an alarm.

2. The operator will select and energize the proper "green band" circuit as the truck leaves to answer the call.

3. The fire operator will energize the fire service switch.

4. The fire operator will notify all cars and stations, via radio, of the location of the fire.

5. The last fire vehicle in the convoy to clear the "green band" zone will notify the fire radio operator that he has cleared.

6. The fire operator will return the lights to normal operation.

B. Police Department

1. The vehicle operator will request the "green band" clearance and designate which band he wants.

2. The police operator will call the fire department via radio, or phone and request clearance for the proper "green band".

3. The fire operator will energize the proper "green band" and the police service switch.

4. The police car is notified, via radio, that he has clearance.

5. The police car will notify the police operator when he has cleared the "green band" zone.

6. The police operator will notify the fire operator via radio or phone.

7. The fire operator will return the signals to normal operation.

C. Ambulance Service

1. Ambulance firms will call the Fire Department and request that a "green band" clearance be granted and hold the line open until the ambulance is within a reasonable distance (2 blocks) of the "green band" zone.

(Note: This information should be obtained from the ambulance via two-way radio).

2. When the fire operator is notified that the ambulance is near the "green band" zone he will then energize the proper "green band" and the ambulance service switch.

3. The ambulance operator will notify his office as soon as he has cleared the "green band" zone, via radio.

4. The ambulance office will notify the fire department and the signal lights will be returned to normal operation. (Note: This procedure is to be followed whether the ambulance is answering an emergency call or returning with the patient, if he makes use of the "green band").

A list of intersections which are included in the system and the designated routes will be supplied to all users of the "green band" system. The operator of an emergency vehicle can determine whether or not he has his "green band" clearance by observing the signal light. When the "green band" is in operation the green lights in the band requested will be pulsating (very fast flashing). The lights on the cross streets will be red.

It should be stressed that there can be a malfunction in the controller that would cause the intersection lights not to respond to the call for "green band" operation. If this should happen the vehicle operator can detect this because the lights will not be pulsating but will be a steady green or red. If the operator detects a steady burning light, green or red, he must assume that he does not have clearance through the intersection.

With a system of this nature, there must be a priority established. After consideration of all factors, the priority was established as follows:

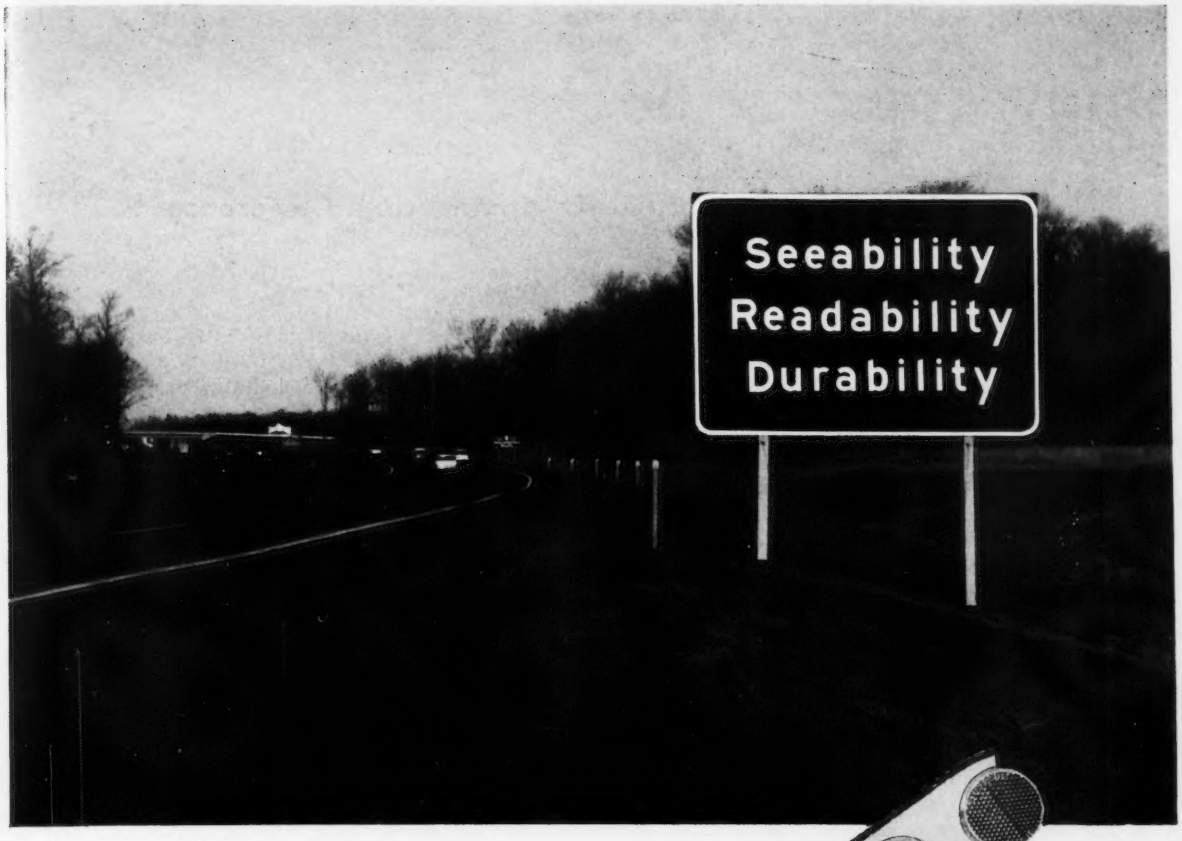
1. Fire Department
2. Police Department
3. Ambulance Service
4. Other Service

Example: If requests from the police department and an ambulance service were received at the same time, the police department would receive clearance and then the ambulance service. After "green band" clearance has been energized for any service it will not be turned off until the fire department has been notified by the service that requested the "green band" clearance that the emergency vehicle has cleared the "green band" zone.

There is one exception to this rule. If the fire department should receive an alarm which requires a fire vehicle from central fire station to make an emergency run through the "green band" zone while an emergency run is being made by any other service, the clearance for that service will be terminated *without notice*. The clearance will be given to the fire department. This situation will occur very seldom; however, when this does take place the operator can detect that he has lost his clearance by observing the lights. He will notice that he no longer has the pulsating green light, if his movement will conflict with that of the fire department vehicle, and that instead he will have either a steady red light or a steady green light.

Under any of these conditions any emergency vehicle would assume that he does not have the "green band" in his favor. He would proceed through the intersection only with extreme caution.

The "green band" system has been in effect since July 25, 1960 and the City of Greensboro is well pleased with the results. While there is some delay along the pre-determined routes, the remainder of the street system is free to move traffic. Another important factor is that the system is returned to normal operation more rapidly due to the emergency vehicle reporting when he is clear of the system.



STIMSONITE SIGNS THE WAY

No question why STIMSONITE is first choice for signs on the nation's modern highways.

STIMSONITE is more seeable! With their unique prism construction, STIMSONITE reflectors provide target value at greater distances than any other reflective material.

STIMSONITE is more readable! These bright letters are designed for the best legibility and clarity day, night, dawn or dusk.

And STIMSONITE is more durable! It will not fade or chip. Signs made with STIMSONITE letters, borders and symbols are permanent. They never need renewing or costly maintenance. For long term efficiency and economy, let STIMSONITE sign the way for you.

STIMSONITE SIGNAL PRODUCTS

ESNA

ELASTIC STOP NUT CORPORATION OF AMERICA
ELIZABETH DIVISION ■ ELIZABETH, NEW JERSEY

IN CANADA: ESNA CANADA, LTD., 12 GOWER ST., TORONTO 16, ONTARIO, CANADA

Study Tour by Bus

Following the World Traffic Engineering Conference

A special event, scheduled to follow immediately after the World Traffic Engineering Conference in Washington, will be a Study Tour by Bus, starting Monday, August 28, and ending Saturday, September 2.

Originating in Washington and extending up the East Coast to New Haven, the tour will provide an ideal opportunity to study at first hand things done, under way or planned to meet the growing pressures on highway and street facilities.

Shown below is the itinerary, together with the principal contacts in each important city on the route.

Washington (Harold L. Aitken, Director of Highways and Traffic; Francis E. Twiss, Deputy Director for Traffic Engineering and Operations, Department of Highways and Traffic).

Prior to the six-day bus tour, visitors will have free time to observe traffic handling and facilities in Washington. Doubling in population in two decades, the Washington metropolitan area has unusual traffic problems requiring unique treatment, both in operations and new facilities.
(The August issue of *Traffic Engineering* will carry an article on Washington traffic problems.)

Buses will leave the Sheraton Park Hotel in Washington at 8:30 A.M., Monday, August 28, traveling over the four-lane Baltimore Washington Parkway which largely traverses park lands on the 40-mile trip to Baltimore.

Baltimore (Henry A. Barnes, Commissioner, Department of Transit and Traffic; Edward F. Cleary, Deputy Commissioner.)

This picturesque industrial and shipping center has a multiplicity of narrow streets, some probably dating back more than 200 years. Baltimore is the nation's sixth largest city, ranks second in shipping, and is the home of Ft. McHenry where the national anthem was written. To ease traffic movements, Baltimore has the world's largest installation of electronic traffic control, three powerful municipal radio systems, has modern traffic sign and marking shops and one of the country's most modern electronic signal construction and maintenance shops. The tour will include the Jones Falls Expressway project, now well under way, consisting of a six-lane freeway being built through the heart of the city under difficult conditions.

Philadelphia (Richard A. Overmeyer, Deputy Commissioner, Department of Streets; Stephen E. Butterfield, City Traffic Engineer, Bureau of Traffic Engineering.)

Philadelphia is a fascinating mixture of old and new. Independence Hall in which hangs the Liberty Bell, Carpenter's Hall, Old City Hall and many other early points of interest, vie with modern construction for the interest of visitors. This fourth largest city in the United States has traffic problems of great magnitude, which are compounded by the hundreds of thousands of Philadelphia-bound people who live on the New Jersey side of the wide Delaware River.

Electronic traffic controls are being used, new expressways are being built and great progress is being made in urban renewal. New structures are being built in the downtown area, which with underground traffic and pedestrian facilities have changed a slum into an area of high land values. Visitors will also see the Independence Mall renewal project which will reconstruct an historical area where much of our national government was founded.

A highlight of the tour will be a visit to the headquarters of the three-year Pennsylvania-New Jersey Transportation Study now in progress. This is one of the largest cooperative efforts of its kind ever undertaken. It involves two states, five counties, the City of Philadelphia and the Federal Government. Also to be covered are the modern combined sign and signal shops.

Leaving Philadelphia the important Benjamin Franklin Bridge over the Delaware River to Camden will be crossed and thence to the world famous New Jersey Turnpike. On the Turnpike, opportunity will be given to observe toll collection methods, motorist service areas, and other features of interest.

New York City (T. T. Wiley, Commissioner, Department of Traffic; Gordon Gravelle, Deputy Commissioner; Louis E. Bender, Chief, Traffic Engineering Division, Port of New York Authority; Edward G. Wetzel, Special Assistant to Director of Port Development, Port of New York Authority.)

The hub of a metropolitan area of more than 15 million people, tremendous commercial and passenger car traffic volumes, a great port area, 60,000 parking meters, multitudes of pedestrians, —all add up to a king-size traffic engineering headache as New York officials testify.

A visit will be made to the offices of the Department of Traffic where a briefing will be given on the multiplicity of the city's problems and what is being done to meet them. The tour will cover projects of both the Department of Traffic and the Port of New York Authority.

New York City has many types of transportation and traffic operations—mechanical and ramp type parking garages below and above ground; one-way arterial street systems controlled by progressive signals with additional remote radio control of principal areas; bridge and tunnel river crossings having reversible lanes for predominant directional flow of traffic; large modern bus terminals and truck terminals. An appropriate selection of these facilities will be included in the study tour.

Two evenings in Manhattan will be free for sightseeing. The United Nations building, the Empire State building rising 1,472 feet, Radio City, the unique Solomon R. Guggenheim museum and many other world-famous

structures may be observed in this, the world's most "vertical" city.

Norwalk, Connecticut Leaving New York City, the buses will travel on the 129-mile Connecticut Turnpike, a high speed freeway costing some $445 million (including cost of new rights of way), parts of which were opened just a little more than a year ago. This freeway was built to connect cities and towns, and goes to and through almost the centers of many communities. Connecticut, while having a delightful countryside, has much industry, although many manufacturing plants are small. Many factories of famous products will be seen en route.

While there are many manufacturers of traffic signal control equipment in the U. S. A., the only one along the route to be traveled is at Norwalk, Connecticut, A short stop will be made at this plant to see equipment actually in production. Various types of electronic control and radar equipment for both traffic direction and enforcement will be shown.

New Haven (Fred W. Hurd, Director, Yale Bureau of Highway Traffic; William R. McGrath, Director of Traffic and Parking.)

From Norwalk the tour will proceed over the Connecticut Thruway to New Haven, the home of Yale University. Here is located the Yale Bureau of Highway Traffic, the oldest and probably the best known of the traffic engineering training centers.

This school annually provides instruction for traffic specialists from various parts of the world. Many of those on the tour will have graduated from the school and will welcome the opportunity to again visit their Alma Mater. Classrooms and methods of instruction will be observed, as will the library which is considered the best and most complete library on traffic matters.

Since New Haven is one of the leading medium sized cities in urban renewal, the tour will include interesting New Haven projects.

General Information

Guides familiar with the cities and projects covered on the tour will be at hand to describe and discuss the facilities and problems throughout the tour. This informational service, directed by Alan Voorhees, consultant, formerly of the Automotive Safety Foundation, will be provided with assistance of representatives of the American Automobile Association. Along the way, officials and staff members of the cities and agencies will join the tour to aid in providing full information.

On the return trip to Washington, those who desire may leave the tour at New York City or other points.

Reservations and Costs

Since buses and accommodations must be reserved long in advance, it is important that those planning to take the tour notify the local committee as soon as possible. Fill out the pre-registration form in the centerspread of the May issue of TRAFFIC ENGINEERING, or write at once to David Solomon, Chairman, Registration Committee, WTEC, c/o Bureau of Public Roads, Washington 25, D. C.

The cost per person for the tour will be approximately $170, which will include all transportation, rooms and meals for the week (from Washington to New Haven and back to Washington).

for DURABILITY...READABILITY...STRENGTH...

modern trailblazers install MIRO-FLEX embossed street name assemblies

The solid, permanence of MIRO-FLEX embossed street name assemblies commands respect wherever they are installed — an expression that the community takes pride in its town. These tough, durable assemblies withstand weather wear, offer snap-out legibility with the smart styling that complements both suburban developments and the groomed elegance of established neighborhoods. Made of zinc-coated, Bonderized steel with baked-on enamel finish, MIRO-FLEX signs are embossed for extra strength and rigidity. They can be reflectorized with moisture-proof beads or reflective sheeting. Buy MIRO-FLEX assemblies. Competitive makes are... rarely as attractive... never so enduring.

The Finest Complete Traffic Control Sign Line in America

Stop Signs | Regulatory Speed Signs | Warning Signs | School Signs | Yield Signs

THE MIRO-FLEX CO., INC. 1824 E. SECOND ST. WICHITA 14, KANSAS

MS-861

Standard Traffic Signs Available for Immediate Delivery at Northeastern Warehouse
Koontz Equipment Corporation, 325 Ohio River Blvd., Emsworth, Pittsburgh 2, Pa.

Traffic News

First Inter-American Traffic Seminar

The First Inter-American Traffic Seminar under the sponsorship of the Organization of American States, will be held at the Pan American Union from September 4 to 8, 1961. Well-known experts in traffic engineering from all the countries of America will participate in the Seminar.

Registration will be free, and all persons interested in traffic problems are cordially invited to participate as observers.

The Organization of American States has been interested for some time in the joint study and solution of problems relating to international traffic in the hemisphere by all the member states.

The Sixth Pan American Highway Congress, Caracas, 1954, recommended that "a meeting of experts on traffic" be convoked; such a meeting was held in Panama in 1957. In view of its successful outcome, it was decided to request the Organization of American States to take the necessary measures to hold traffic congresses concurrently with Pan American Highway Congresses. It was also recommended that traffic seminars be held until such time as the Council reached a decision regarding the aforementioned congresses.

Inasmuch as the 31st Annual Meeting of the Institute of Traffic Engineers and the International Sessions in Traffic Engineering are scheduled to take place in Washington, D. C., in August, 1961, the Eighth Pan American Highway Congress recommended that the First Inter-American Traffic Seminar be held in conjunction with these two meetings. (Res. XLVII).

Several official and private organizations have cooperated in the organization of the Inter-American Traffic Seminar: the U. S. Bureau of Public Roads; the International Road Federation (IRF); the Institute of Traffic Engineers; the Inter-American Federation of Automobile Clubs (FIAC); and the Automotive Safety Foundation.

The Agenda for the Seminar is shown below.

Additional information may be obtained by communicating with the: First Inter-American Traffic Seminar, Permanent Secretariat, Pan American Highway Congresses, Pan American Union, Washington 6, D. C.

FIRST INTER-AMERICAN
TRAFFIC SEMINAR
September 4-8, 1961
Pan American Union
Washington, D. C.

AGENDA

1. *Traffic safety*
   a. Present status and its future.
   b. Educational programs.
   c. Night driving visibility.
   d. Statistics and investigation of accidents in the streets and highways, and use of this information for safety purposes.
   e. Other subjects.
2. *Need for comprehensive traffic programs and relationship to urban and regional planning.*
   a. Benefits attained by overall traffic studies in specific cities.
   b. The application of the gravity model to Latin American cities.
   c. Other subjects.
3. *Traffic engineering*
   a. Importance, objectives and accomplishments of traffic engineering.
   b. Traffic operational methods, devices, controls, etc.
   c. Need to increase understanding of the importance of traffic engineering in the American countries.
   d. Traffic engineering education and training.
   e. Traffic engineering administration.
   f. Other subjects.
4. *Responsibilities of traffic police*
   a. Traffic police administration.
   b. Traffic supervision by the police.
   c. Cooperation between the police and the traffic engineer.
   d. Special training on traffic for the police.
   e. Other subjects.
5. *Improving traffic conditions through modern street and highway design.*
   a. Good geometric design to provide driving safety and comfort.
   b. Dissemination of practical design methods.
   c. Other subjects.
6. *International cooperation programs*
   a. Organization of American States.
   b. United Nations.
   c. International Cooperation Administration.
   d. International Road Federation.
   e. U. S. Bureau of Public Roads.
   f. Institute of Traffic Engineers.
7. *Progress on traffic ideas presented at the Inter-American Meeting of Traffic Experts (Panama, 1957) and Eighth Pan American Highway Congress (Bogotá, 1960).*
8. *Practical decisions and actions to be taken in the American countries as a result of the XXXI Annual Meeting of the Institute of Traffic Engineers, the International Sessions on Traffic Engineering and the First Inter-American Traffic Seminar* (open discussion).

Awards By ITE To 36 States & Cities

Five states and 31 cities have been honored by the Institute of Traffic Engineers for their traffic engineering work in 1960. The awards, which were based on information reported to the Annual Inventory of Traffic Safety Activities of the National Safety Council, were made by a committee of judges of the Institute. Chairman of the Committee was Dr. Donald S. Berry, Professor of Civil Engineering at Northwestern University. Other judges were John E. Baerwald, Professor of Traffic Engineering, University of Illinois; Evan E. Olmstead, Traffic Engineer, Chicago Transit Authority, and member of the Institute's Board of Direction; and Matthew S. Sielski, Director of Traffic Engineering and Safety, Chicago Motor Club, and past President of the Institute.

Traffic planning, traffic control measures, traffic improvements and traffic engineering administration were among the items considered in making the awards. More than 800 cities and states submitted entries in the inventory program, which is designed as a self-evaluation of the traffic safety program of a city or state. The awards made by the Institute were all designated as "for maintaining a high level of performance in traffic engineering in 1960," and no ranking was indicated by the judges.

long, rugged and handsome

THIS **PLANET** ALL-ALUMINUM 120-FOOT OVERHEAD SIGN STRUCTURE NEAR LOUISVILLE, KENTUCKY CAN WITHSTAND HURRICANE-FORCE WINDS

One of several Planet illuminated aluminum overhead sign structures erected over the Louisville Expressway System. Lengths: 75', 90', 120'.

Planet all-aluminum overhead sign structures are rugged . . . the box-truss design enables Planet sign structures—*even structures 120-feet long*—to support large overhead signs and lights in winds in excess of 100 m.p.h.

And Planet sign structures are handsome . . . the aluminum's smooth, clean appearance, and natural defiance to the elements assures you that these inexpensive-to-erect overhead sign structures will *stay attractive for years without maintenance.*

Write or call for complete information. Planet all-aluminum overhead sign structures are available in span lengths of 50 to 120 feet.

PLANET CORPORATION

1842 SUNSET AVE., LANSING, MICHIGAN

Planet overhead sign structures have been erected over highways in Arkansas, Mass., Iowa, Kentucky, Mich., New Hampshire and Ohio, and are under construction for others.

01

The states receiving awards were: California, Connecticut, Maryland, Michigan and Rhode Island.

Cities receiving awards were: Arkansas-Little Rock; California-Los Angeles, Modesto, Stockton; Colorado-Pueblo; Illinois-Evanston, Moline; Indiana-Indianapolis, West Lafayette; Kansas-Garden City; Maryland-Baltimore; Michigan-Detroit, Kalamazoo; Missouri - Clayton; Nevada - Reno; North Carolina-Charlotte; Ohio-Dayton, East Cleveland, Shaker Heights; Oklahoma - Tulsa; Oregon - Medford; Pennsylvania - Lancaster; Rhode Island-Providence; Texas-Borger, Dallas,Waco; Virginia-Alexandria; Washington - Seattle; Wisconsin - Madison, Menasha, Milwaukee.

Transportation Study For Los Angeles

Another regional transportation study has been added to the growing list of such studies being undertaken around the country. This one encompasses the five counties and 116 cities making up the Los Angeles Metropolitan area.

The Los Angeles Regional Transportation Study—LARTS—will utilize the latest land use and traffic model techniques in conjunction with high speed computers to determine the transportation needs for the area for 1960-65-70-75-80 and into the future. The study area embraces approximately 9,000 square miles including most of the area between Santa Barbara and San Diego. It is separated from the latter two areas by natural barriers. All of Ventura, Los Angeles and Orange Counties and the westernmost portion of San Bernadino and Riverside Counties are incorporated in the study limits. There are approximately 8,000,000 people now living in this area and motor vehicle registration totals 4,000,000. Projected to 1980 these figures become 15,000,000 and 8,000,000.

A great deal of work has been done on transportation planning in the area encompassed by the study. However, these earlier efforts were confined to smaller areas and did not take account of the wide circulation of people and goods which has been brought on by the dynamic growth of this metropolitan region. The new study is organized as a continuous planning operation utilizing new data as it becomes available and developing greater refinements of study techniques. Whole freeway systems and several concepts of mass transportation will be tested in relation to varying land use proposals.

Some of the quantitative goals set forth for the first two years of the study include:

1. A complete pattern of the movement of people and goods for the entire study area.

2. A complete analysis of vehicular transportation needs on a local and region-wide basis.

3. The Average Daily Traffic volumes for the freeway system, and major arterial and collector streets.

4. Objective evaluations of transportation needs, of present land use and future land use plans proposed by the city and county planners.

5. A data summary of population, employment, motor vehicle ownership, etc., and an inventory of land use for every local community by census tracts.

The study is also designed to yield qualitative results during the first two years which can be used to refine the techniques followed in succeeding years. Some of the expected qualitative results are:

1. A greatly increased understanding on the part of planners and engineers of the interrelationships between land use and transportation planning.

2. A greater appreciation of the value of well coordinated, systematic, uniform data collection.

3. A better understanding of the factors influencing residential, industrial, and commercial land development.

4. A better insight to patterns of growth on a local and region-wide basis.

5. An increased awareness of the effect each community's planning has on surrounding communities and the region as a whole.

6. The land use models developed in this study will provide powerful tools to the local communities for testing and evaluating alternatives of existing and future land use and transportation plans. In addition they furnish the kind of information needed by local authorities for orderly planning of vital community services such as sewer, water and street improvements.

The study is being conducted under the general coordination of the California Division of Highways with the cooperation of the Bureau of Public Roads, the five counties, the 116 cities within these counties and several public and private organizations. Mr. Edward H. Telford, an Assistant State Highway Engineer with the California Division of Highways has been designated as LARTS Study Director.

Urban Traffic Facilities Conference Held in Texas

The second of a series of semi-annual Urban Traffic Conferences was held in Tyler, Texas, on May 9 and 10. The Conference was attended by 93 delegates, including 50 representatives of the Texas Highway Dept., 26 representatives of cities, four from counties, six from colleges and seven from various other organizations. The Conference was sponsored by the Texas Section of the Institute of Traffic Engineers, The Texas Municipal League and the Texas Highway Department. The Highway Design and Traffic Engineering Staff of Texas A & M College directed the meeting.

The Conference had a three-fold purpose: to gain a better understanding of the problems and philosophies of the agencies responsible for urban traffic; to develop a closer relationship between the individuals representing these agencies; and to provide opportunities for those individuals to become better acquainted.

The first day of the Conference was aimed at outlining the responsibility of the administrators of the various interested agencies in dealing with urban traffic problems. The program included talks on the responsibility for streets and highways, organizing for the job, planning and designing for traffic and standards of street design and service. The first session of the second day of the Conference included talks by various city and highway de-

Left to right: J. E. Wright, President, Texas Section Institute of Traffic Engineers; Will Mann Richardson, Vice President, Citizens First National Bank of Tyler and Chairman of the Highway Committee, Tyler Chamber of Commerce; W. W. Potter, District Engineer, Texas Highway Department in Tyler.
Photo by Courier Times staff of Tyler, Texas.

partment traffic engineers on the actual procedures in planning, design and operation of urban facilities. The final session of the program was a panel discussion on "Making Better Use of Existing Facilities," with all speakers of the Conference participating.

Rapid Transit Institute Formed

The Institute for Rapid Transit, a new nationwide organization established to promote development, expansion and modernization of rapid transit in metropolitan areas, was launched June 7 in Philadelphia by a group of prominent transit operators and equipment manufacturers.

To meet today's transit needs, the Institute for Rapid Transit replaces the Transit Research Corporation, formed in the early '30's by transit operators and manufacturers to develop a modern streetcar which itself has now become a victim of progress and is passing from the transit scene.

TRC's contribution to the art was the PCC (President's Conference Committee) streetcar. Its outstanding quick-starting, quick-stopping characteristics are now being perpetuated in today's modern rapid transit cars.

Headquarters of the not-for-profit Institute for Rapid Transit are being established in the Merchandise Mart in Chicago. Officers elected were: President—Walter J. McCarter, general manager of Chicago Transit Authority and former president of TRC; Vice President and Treasurer—Donald C. Hyde, general manager, Cleveland Transit System; Executive Secretary—David Q. Gual, formerly engineer for TRC.

Directors of the new organization are J. G. Inglis, general manager, Toronto (Canada) Transit Commission; T. J. McLernon, general manager, Metropolitan Transit Authority of Boston; C. D. Palmer, president, Pittsburgh Railways Company; and Mr. McCarter and Mr. Hyde.

Charter members are the Boston Transit Authority; the Chicago Transit Authority; the Cleveland Transit System; the Pittsburgh Railways Company; the Toronto Transit Commission; the General Electric Company of Schenectady, New York; the General Steel Castings Corporation of Granite City, Illinois; the Pullman-Standard Car Manufacturing Company of Chicago; the St. Louis Car Company; the Westinghouse Electric Corporation of East Pittsburgh, Pennsylvania; and the Westinghouse Air Brake Company of Wilmerding, Pennsylvania.

Other organizations, invited to the meeting of the Institute, were:

The Atlanta (Georgia) Transit System; ACF Industries, Inc. of New York City; the Budd Company of Philadelphia; the Delaware River Port Authority of Camden, New Jersey; the Los Angeles Metropolitan Transit Authority; the L.M.F. Manufacturing Company of Atchison, Kansas; the Midland-Ross Company of Owosso, Michigan; the Montreal Transit Commission; the National Capital Transportation Agency of Washington, D.C.; the Philadelphia Transportation Company; and the San Francisco Bay Area Rapid Transit District.

Specific objectives of the Institute for Rapid Transit are to promote and co-ordinate technological advances in rapid transit equipment and facilities; to collect, analyze and distribute data on technologies and developments pertinent to the progress of rapid transit; to co-operate with the American Transit Association in matters concerned with rapid transit; to maintain liaison with planning and other organizations; to serve as spokesman for the rapid transit section of the transportation industry; and to study rapid transit planning, and co-ordination of rapid transit and suburban railroad planning, when requested.

Catholic University Offers Graduate Level Traffic Courses

Catholic University of America (Washington, D. C.) has announced seven graduate level courses in highway and traffic engineering for the coming academic year. Four courses are to be offered the first semester, and three the second semester.

First semester courses, credit hours, and instructors are: Traffic Engineering—3 hours—John H. Mitton; Highway Design—3 hours—Forest H. Green; Highway Research Seminar—1 hour—Dr. Paul J. Claffey and staff; Transportation Planning—2 hours—Dr. Paul J. Claffey.

Second semester courses are: Highway Economics and Finance—3 hours—Robley Winfrey; City Planning—3 hours—Dr. Paul J. Claffey; Highway Administration—3 hours—Forest H. Green.

stop meter thefts!

with

NIX-PIX

Locks

■ First Philadelphia and now Seattle has chosen NIX-PIX locks for their parking meters. The reasons apply to any municipality, including yours. The strongest meter is only as secure as the lock. No lock can guarantee absolute security but NIX-PIX comes far closer than other locks available. NIX-PIX locks, each with 65, 536 combinations is the answer. Even if an ingenious thief, after long tedious effort, could fashion the right key, he'd find his first theft the last. A city employee with the NIX-PIX withdrawal key quickly changes the combinations and the thief's key is useless. You never need replace NIX-PIX locks for security reasons.

Write for FREE lock folder

NIX-PIX LOCKS
115 L Street, S.E. Washington 3, D.C.

UCLA Launches $650,000 Study to Cut Human Traffic Toll

An ambitious $650,000 research program has been launched at UCLA to help cut this country's staggering traffic death and injury toll, with the emphasis on changing not the driver himself, but the performance of his car.

Financed by a grant from the U. S. Public Health Service, the five-year study will be conducted by Professor John H. Mathewson, Derwyn M. Severy and Arnold W. Siegel of the Institute of Transportation and Traffic Engineering, UCLA Department of Engineering.

The three veteran car-collision experts, drawing on the Institute's 11 years of research, will investigate material and design changes to strengthen the car body and keep the driver from being battered inside the car during a crash. They will test their laboratory findings through actual controlled car collisions.

Six high-priority goals head the research list:

1. Cut the amount of free, unrestricted space between the driver or passenger and the sides of the car. Experiments have shown that during a crash, the relative speed with which the occupant is hurled against the car doors, dash board or other solid inside objects increases with their distance from his seated position. In addition, the bigger the distance, the more likely the occupant is to strike headfirst.

One protective method is to reduce the distance by interposing restraining devices, another to lessen the force of the impact through crush-resistant inside paneling. The investigators will study and test hip-fitting bucket seats, dividing arm rests, special head supports, and different designs for dash boards, side panels, and the back part of front seats.

2. Develop special safety harnesses for infants and children. Conventional safety belts are of little use for children, and the Institute team is working on parachute-type and dog-leash harnesses which might protect restless youngsters while sitting, standing or lying down. An extra benefit of the harness might be to keep youngsters from crawling all over the driver.

The harnesses will be tested in staged car collisions, using highly realistic instrumented dummies of infants and children.

3. Evaluate, through experimental collisions, how the basic car structure might be changed, strengthened, or made more or less rigid, to cut driver and passenger injuries.

4. Test high-strength, shock-absorbing materials, such as honeycomb laminates and foam-in-place metals and plastics. These could be applied to different parts of the car, especially at the front end under the hood.

5. Protect pedestrians, especially the very young and old, through changes in car front end design. For instance, by changing the contour and height of the front bumper and associated front-end sheet metal, pedestrians might be carried over the top or deflected to the side of the car, instead of being crushed under the wheels.

6. Exchange information with other researchers in the car collision field to get a clearer idea of what has been accomplished throughout the world.

A secondary group of projects will include studies of driving-assist devices, for example, audio-callouts, which will report the speed of the car. Thus the driver need not look at the speedometer, but can keep his eye on the road.

The three-man team also plans to improve present devices, such as left-foot brakes and retractable seat belts; check the relationship between accident and maintenance and mechanical deficiencies; and investigate conditions leading to car component or systems failures, such as inherent dynamic instabilities, tubeless tire weaknesses, and stress relations in power steering parking.

Throughout the five-year program, the Institute will publicize its findings through reports, meetings and films, for the information of the highway transportation industry, car manufacturers, law enforcement agencies, the legal and medical professions and the general public. In its research, the Institute will draw on the skills of UCLA and outside physicians, psychologists, mathematicians, engineers and statisticians.

"We do not expect to come up with all the answers during our study, and we certainly are not in the business of redesigning cars," says Professor

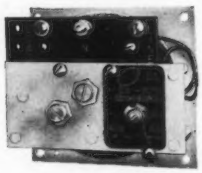
For Flashing Signals and Beacons

Specify The Flashers With Performance Proven Dependability

engineering and design features that have made Time-O-Matic the leading manufacturer of flashers since 1932

- open frame construction for efficient heat dissipation
- adjustable 50-60 flashes per minute
- not affected by extreme temperature variations
- slow speed induction motor
- hardened, polished pivots
- bearings, factory lubricated for life of the flasher
- available with or without radio interference eliminators

NEW ! !
Model 46
1 or 2 circuit, front-mounted cams and contacts out in the open for fast, easy adjustment, replacement. Compact size 4⅜" high, 4" wide, 2¼" deep



Model 3
1 or 2 circuits

Model 37 Jack-mounted
Available with or without meter base and cover, as shown, 1 or 2 circuits

Applications

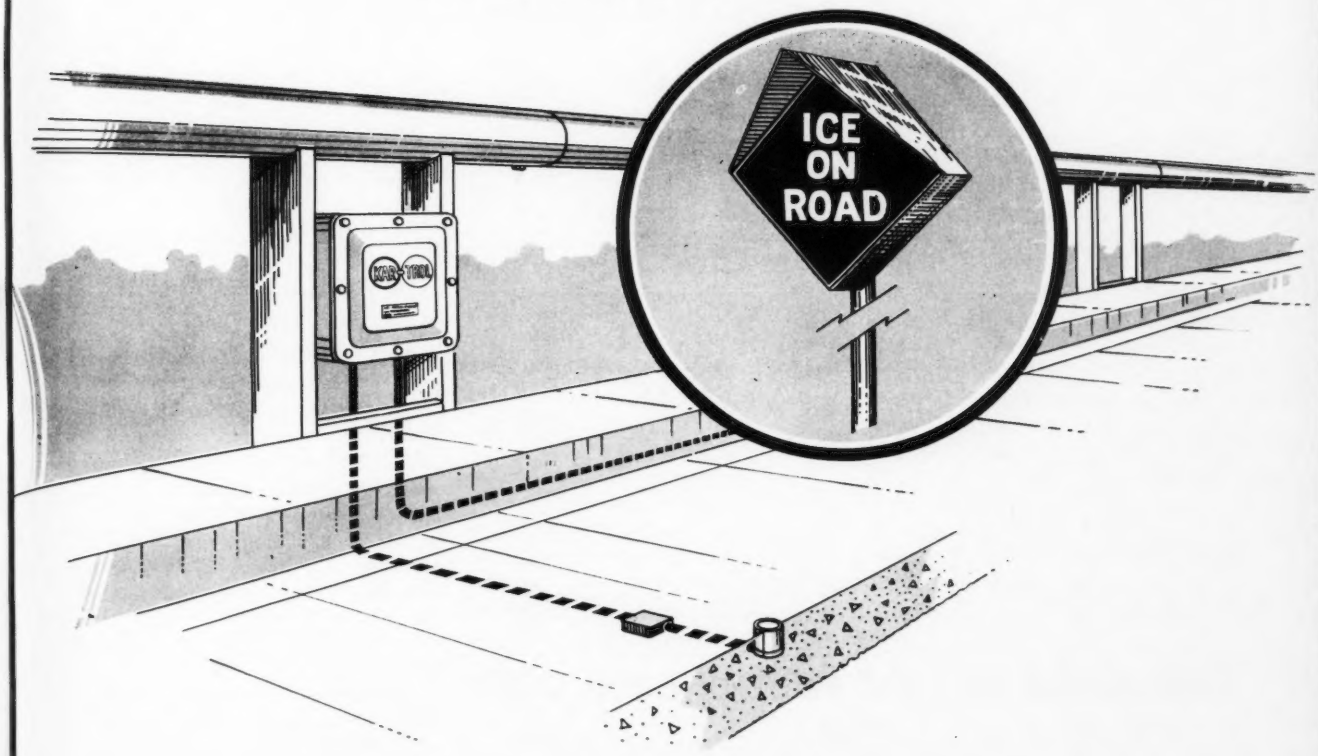
Safety Zones
Caution Signals
Traffic Islands
Loading Zones
Warning Beacons
Flashing Stop Signs

Write for literature and specifications

TIME-O-MATIC
Division of E-S Industries, Inc.
A SIGN OF GOOD CONTROL SINCE 1932
P.O. Box 850, Danville, Illinois, Phone Hickory 2-0611
Canadian Agent: Sangamo, Ltd. • Leaside, Toronto 17, Canada

NEW

ICE—SNOW—FROST DETECTOR



AUTOMATICALLY AND IMMEDIATELY DETECTS ICE, SNOW OR FROST ON SURFACE OF BRIDGES, STRUCTURES OR ROADWAYS AND WARNS APPROACHING TRAFFIC OF THESE CONDITIONS BY THE USE OF BLANK OUT, WARNING SIGNS.

***Can be supplied to detect and warn of wet surfaces as well as Ice, Snow or Frost*

Write for full details, specifications and special applications.

KAR-TROL **Signal Company Inc.**

COPYRIGHT 12739 SOUTH MAIN ST. • HOUSTON 35, TEXAS

Mathewson, who is assistant director of the Institute. "Our main job is to evaluate and test various designs and devices, and pass on the results to car manufacturers and public agencies concerned with accident prevention.

"Nevertheless, the importance of our study can hardly be overestimated in the light of the frightening traffic toll on our roads and the relatively small amount of research that has been done in this field."

Each year, Professor Mathewson points out, traffic accidents in the United States cause 40,000 deaths and 6,000,000 reported injuries. In the 15-24-year age group, car accidents are the leading cause of death.

Nevertheless, only pennies have been spent for effective research in accident prevention, compared to the large amounts of money available in fighting other killers.

For instance, in 1959 Dr. James Goddard of the Department of Health, Education and Welfare told a Congressional Committee that for each aviation death, $500,000 was spent on research aimed at preventing accidental fatalities in the future.

The comparative figures for each polio death were $40,000, for cancer $360, and for heart disease $87. For each traffic death, the figure was $2.50.

For each non-fatal injury or case under treatment, research costs were $10,000 for polio, $130 for cancer, $7.80 for heart disease—and 70 cents for each traffic injury.

"We are, of course, not belittling the importance and effectiveness of research in other health areas," says Professor Mathewson. "But we might keep in mind that the average motorist spends from six to ten weeks working time each year just driving his car, and many more as a pedestrian and that during that cumulative time is exposed to accidents.

"No wonder, then, that traffic injuries have been called the nation's most serious health problem. It will take the combined energetic action of many groups, and substantial sums of money for needed research, before we can lick the problem."

IRF Fellowships Total Over $900,000

More than $900,000 has been provided by the International Road Federation on its fellowship program for the training of foreign engineers in the United States.

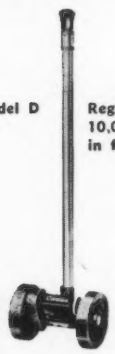
The program, inaugurated in 1949, has trained 264 engineers from 71 countries. These engineers have attended graduate schools at Ohio State, Northwestern, Purdue, Yale, Illinois, University of California and Massachusetts Institute of Technology.

The program which started with two fellowships, now averages 40 annually. The number of applications from highway engineers throughout the world, particularly those in the new republics of Africa, is continually increasing.

FOR MANY TRAFFIC ENGINEERING USES

THE...

Shalda MEASURE METER



Model D

Registers up to 10,000 ft. in feet & inches.

Direct Reading • No Bells • No Counting
No Computing • Fast Reset to Zero

Special for the TRAFFIC ENGINEER: Graduated in either 10ths or 12ths

The Shalda Measure Meter has been put to practical use by traffic engineers all over the nation. Its simplicity and accuracy has proven tremendously valuable in traffic engineering and has been accepted as a useful and practical tool.

- Rust, dust, moisture resistant, sealed in mechanism.
- Light, weighs only 3 pounds.
- Extension handle to 40 inches.
- Finest precision counters.
- Trouble free, factory lubricated.
- Handy, portable—only 23 inches long.

FAST!! SIMPLE!! ACCURATE!!

Automatically adds or subtracts. No other machine has this feature.

Just walk it ahead—the precision computer clocks off feet and inches like an automobile speedometer...with equally simple reading. To subtract—just back it up.

At only $49.50 will pay for itself many times over.

Distributed by

B. G. REILLY COMPANY

P. O. Box 231, N. Scituate, R. I.
P. O. Box 3393, W. Hollywood, Fla.

— Dealer Inquiries Invited —

3M vs. Flex-O-Lite Suit Dismissed

The United States District Court for the Eastern District of Missouri, Eastern Division, at St. Louis, Missouri, has entered a final judgment in the case of Minnesota Mining & Manufacturing Company vs Flex-O-Lite Manufacturing Corporation, St. Louis, Missouri, Civil Action No. 59C78 (2), concerning alleged infringement of Minnesota Mining & Manufacturing Company's Patent No. 2,326,634. The judgment, by Judge Harper entered March 27, 1961, held that Flex-O-Lite did not infringe this patent and an injunction requested by Minnesota Mining & Manufacturing Company to enjoin Flex-O-Lite from manufacturing and selling high refractive index glass bead materials for use in reflective coatings was dismissed. The thirty day period for appeal has expired with no appeal taken so the judgment has now become final.

Staff Selected For Washington Transportation Agency

The Federal agency devoted to developing balanced and coordinated transportation for the National Capital Region has virtually completed its top staff selections.

Heading the National Capital Transportation Agency as administrator is C. Darwin Stolzenbach. Appointed by President Kennedy and confirmed by the Senate, he was sworn in May 12.

A civic leader active in transportation studies, Mr. Stolzenbach is a former official of the Department of Commerce. For the past ten years he has been an executive of the Operations Research Office of the Johns Hopkins University directing teams of engineers, scientists, and technicians in seeking answers to complex operational problems for the Armed Forces.

Mr. Stolzenbach has appointed as his top staff:

A. J. Goldenthal, director, office of economics and finance. He is a transportation consultant experienced in government and private industry, author of many studies for public agencies, industrial firms, and foundations.

Edwin H. Seeger, general counsel. He was an associate in the law firm of Covington & Burling, specializing in transportation cases.

Stanley D. Forsythe, director, office of engineering and development. After

a lifetime in the Chicago transit industry, he leaves his post as general superintendent of engineering of the Chicago Transit Authority to join what he calls "the greatest challenge of a lifetime" in the Nation's Capital.

Cody Pfanstiehl, director, office of community service and information. In more than a decade of experience in civic activities of the region, he has been in various public relations positions with the Columbia Broadcasting System, WTOP radio and television (the Washington Post stations), the United Givers Fund, and the Washington Star.

Also with Mr. Stolzenbach are aides previously appointed, including Robert A. Keith (Assoc. Mem., ITE) chief of the division of engineering programs and a former project director of the Mass Transportation Survey Report, and J. Neal Tomey, director of administration.

Coming Events

July 10-12—WESTERN SECTION, ITE, ANNUAL MEETING—
Westward Ho Hotel, Phoenix, Arizona. Contact: Charles E. Haley, City Traffic Engineer, 112 S. Ninth St., Phoenix, Ariz.

August 21-26—WORLD TRAFFIC ENGINEERING CONFERENCE—
31st Annual Meeting, Institute of Traffic Engineers and International Sessions in Traffic Engineering, Sheraton-Park Hotel, Washington, D. C. Contact: ITE, 2029 K St. N.W., Washington 6, D. C.

September 24-29—ILLUMINATING ENGINEERING SOCIETY—
Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo. Contact: IES, 1860 Broadway, New York, N. Y.

October 9-13—AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS—
47th Annual Meeting, Denver Hilton Hotel, Denver, Colorado. Contact: AASHO, 917 National Press Bldg., Washington 4, D. C.

October 15-18—AMERICAN TRANSIT ASSOCIATION—
Annual Meeting, Baker and Adolphus Hotels, Dallas, Texas. Contact: ATA, 355 Lexington Avenue, New York 17, N. Y.

October 16-19—NATIONAL SAFETY CONGRESS AND EXHIBITION—
Congress, Conrad Hilton, and other hotels, Chicago, Ill. Contact: NSC, 425 N. Michigan Ave., Chicago 11, Ill.

October 16-20—AMERICAN SOCIETY OF CIVIL ENGINEERS—
Annual Convention, Hotel Statler, New York City. Contact: ASCE, 33 West 39th Street, New York 18, N. Y.

November 27-30—SOUTHEASTERN ASSOCIATION OF STATE HIGHWAY OFFICIALS—
Annual Convention, Hotel Marion, Little Rock, Ark. Contact: Raif M. Smith, c/o Arkansas State Highway Dept., Little Rock, Ark.

Air Car Seen As No Competitor to Wheeled Vehicles

From experience with a ground effect machine (GEM) or so-called "air-car," two General Motors Research Laboratories engineers have reported it is promising for special jobs but poses no immediate threat to automobiles or other wheeled vehicles in mass transportation.

Speaking before the Society of Automotive Engineers, Charles A. Amann and Jerold W. Scheel said their experimental "air car" skims over the earth with frictionless ease at a 4-inch altitude with driver only, 3¼ inches with driver and passenger. It also operates over water.

Fore and aft fans driven by 15-horsepower engines produce a continuous sheet of air from a peripheral jet around the bottom of the vehicle which in effect rides on a large air bubble.

The GM Research ground effect machine measures 144 inches long, 81 inches wide and 14 inches from ground to deck.

Its future in mass transportation, the engineers said, would depend on some type of guidance system, such as a special guiding roadway. In this application a long distance automatic thoroughfare specially designed for high speeds, perhaps more than 100 miles an hour, would be conceivable.

Without some form of guidance, Mr. Amann and Mr. Scheel explained, the "air car" would be too tricky to handle in traffic. This results from its lack of ground friction or tire-to-road contact of a standard motorcar. A gust of wind that wouldn't faze an automobile becomes a challenge to the driving skill of the pilot of a ground effect machine.

A piece of land that appears level to automobiles and human eye alike is likely to be proved otherwise by the downhill drift of the ground effect vehicle. Even the crown of a road, insignificant to an automobile driver, affects operation of an "air-car."

Another result of the absence of friction with the ground is lack of precision control. "While automobiles routinely pass within a few feet of one another travelling in opposite directions at *relative* speeds in excess of 100 miles an hour, this same maneuver in a ground effect device would be a hazardous stunt," they said.

"It would be a mistake," Mr. Amann and Mr. Scheel concluded, "to overlook the possibilities of the air cushion supported vehicle in specialized applications . . . use over water is an example. In this application the tasks of climbing hills and of maintaining precise control of the vehicle are usually not primary problems . . . Amphibious operation, combining in a single vehicle transportation capabilities over both land and water, offers another promising area."

Their overall engineering verdict: Although a likely candidate for specialized applications, a ground effect device cannot replace the automobile as we know it today.

In the event of any questions about the foregoing, please address your queries to the GM Public Relations Staff, GM Technical Center, Warren, Mich., or call JEfferson 9-5000, Ext. 2186.

U.S. Motor-Vehicle Registrations in 1960

Motor-vehicle registrations in the United States totaled 73,895,274 during 1960, state agencies have reported to the Bureau of Public Roads, U. S. Department of Commerce. Federal Highway Administrator Rex M. Whitton noted that this was a gain of 2.4 million vehicles over the 1959 registrations. The 3.3 per cent rate of increase is one-fourth less than the 4.3 per cent increase of the preceding year.

The 1960 total included 61,682,036 passenger cars, 272,167 buses, and 11,941,071 trucks. Increases over comparable figures for 1959 were 3.6 per cent for passenger cars, 2.7 per cent for buses, and 2.3 per cent for trucks. Bus data reported are estimates of the numbers in operation rather than registration counts; many commercial buses are registered simultaneously in several states.

California had the highest total registration in 1960, with 7.8 million vehicles. Second was New York, with 5.1 million. Texas, Pennsylvania, and Ohio had over 4 million vehicles registered; Illinois and Michigan each had more than 3 million; and New Jersey, Florida, and Indiana had more than 2 million. Seventeen other states each had over 1 million registrations. The ten leading states combined had 54 per cent of the national total.

Smallest registrations, as might be expected, were in states of small area

or sparse population: Delaware, Nevada, Vermont, and Alaska each had less than 200,000 vehicles.

Recent annual increases in total registrations, which reached a peak in 1955 when the automotive industry attained a record sales volume, have been as follows: 1954, 4.1 per cent; 1955, 7.2 per cent; 1956, 3.9 per cent; 1957, 3.0 per cent; 1958, 1.7 per cent; 1959, 4.3 per cent; 1960, 3.3 per cent.

Northwestern Students Win Midwest Section Contest

Civil engineering students at Northwestern University recently won both the undergraduate and graduate-student Technical Paper Contests sponsored by the Institute of Traffic Engineers' Midwest Section. The winners are Joseph A. Wattleworth, graduate student of 713 Bench St., Galena, Ill., and David E. Boyce, senior of 285 Moull St., Newark, Ohio.

Wattleworth's paper was titled "A Critical Examination of Existing Intersection Capacity Charts." He explained the importance of the study: "The capacity of approaches to signalized intersections is one of the most basic and important phases of traffic engineering. Designs and redesigns of individual intersections and entire street systems depend upon the design capacities which are used in the analyses." He added that use of correct design capacity charts is essential, since incorrect charts will result either in an overly costly street system, on in inadequate capacities.

Wattleworth has been awarded both an Automotive Safety Foundation Fellowship and a Walter P. Murphy Research Fellowship for next fall; he will continue his graduate studies toward the PhD at Northwestern next fall.

Boyce will begin studies at the University of Pennsylvania next fall as a graduate student in city planning. He has received a Sears Foundation Fellowship for two years to underwrite the cost of his studies. Title of his paper was "A Proposal for Implementing Federal Policies on Urban Planning and Development."

He stated that, good as new highways and expressways are, they are not sufficient if planned without regard for other aspects of urban development, and if planned without consulting neighboring communities.

New Appointments

Burton Retires; Joins Toronto Consulting Firm

H. Robert Burton (Member, ITE) retired as Director of Traffic for the City of Toronto on April 30 and joined the staff of H. G. Acres and Company Limited of Toronto as Traffic Engineer and Consultant.

H. Robert Burton

Burton was employed by the City of Toronto for thirty years, and was the chief traffic engineer from 1950 to the date of his retirement. A graduate of the University of Toronto in civil engineering, he spent three years in the Canadian Army during World War I and served again from 1941 to 1945 in the Royal Canadian Engineers during World War II.

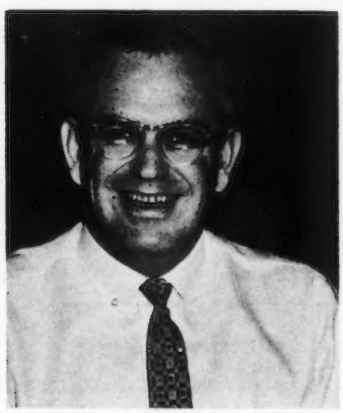
A registered professional engineer in Ontario, Mr. Burton has been active in many professional traffic engineering matters, including service as president of the Ontario Traffic Conference. He has been prominent also in work of the Canadian Section of ITE.

Hudspeth to Wyoming As Assistant State TE

Vealess F. Hudspeth (Assoc. Mem., ITE) recently accepted a position as Assistant State Traffic Engineer with the Wyoming Highway Department in Cheyenne.

In his new position, Hudspeth is responsible to State Traffic Engineer R. C. O'Connell for design and development of sign plans on the Interstate Highway System; intersection and interchange design; and provision of traffic services to small towns and communities in the state.

Prior to assuming his new duties, Hudspeth was an Assistant Traffic Engineer with the Colorado Highway Department, a position he held for three years. Before that he worked four years with the Arkansas Highway Department as a Roadway Designer and then as a Junior Traffic Engineer.



Vealess F. Hudspeth

Hudspeth is a Civil Engineering graduate from Arkansas University and 1955 graduate of the Yale University Bureau of Highway Traffic. He is a registered professional engineer in the states of Arkansas and Wyoming.

In addition to being an Associate Member of ITE, he is also an Associate Member of ASCE and a member of NSPE.

Huntzicker Resigns as Memphis Traffic Engineer

W. P. Huntzicker (Affiliate, ITE) has resigned as traffic engineer of Memphis to enter private business. He will become associated with a new sales firm handling vending machine distribution of canned beverages.

Huntzicker has worked for the city for 28 years, first with the police department and later as city traffic engineer. In 1938-39 he completed the nine-month traffic police administration course at the Northwestern University Traffic Institute.

Huntzicker will be succeeded by Harry B. Skinner, an employee of the city's engineering department since 1957 and a student in the Yale Bureau class of 1960-61.

Bjorklund Heads Lyle Signs, Inc.

Robert H. Bjorklund, formerly Executive Vice President and Secretary of Lyle Signs, Inc., has been elected President by the Board of Directors. In 1960 he celebrated his 25th year with the company. Other new officers are Peter F. Pierce, Vice President; D. M. Pierce, Secretary-Treasurer; and Howard Wallin, Assistant Secretary.

Robert H. Bjorklund

Ross Blunden Revisits Berkeley

Ross Blunden, foundation professor of Australia's first school of transportation engineering, has completed a six-month sojourn as a visiting professor at the University of California's Institute of Transportation and Traffic Engineering at Berkeley, where he developed a special course of lectures and initiated a group of research projects on applications of queuing theory.

Blunden first visited the California Institute in 1956, to study its organization and programs of education and research, and in the same year returned to establish the Australian school at the University of New South Wales, at Sydney. There he began to center his interest on a unified theory of transportation, which underlies his current contributions at Berkeley.

"Unified theory," Blunden says, "holds forth the prospect of much broader based solutions to transportation problems which appear in such aggravated form in the United States and Australia today. And happily, we have at the same time new means—new insights and new facilities for computation—which should make it ever so much easier to put such a theory together.

"The elements of a unified theory appear to be contained in physical flow theory, queuing and waiting-line theory, and probability models of intervehicle events, such as headings and spacings. Aside from the interest and value that come with a full understanding of any physical phenomenon, a unified transportation theory offers the prospect of very practical applications. It requires no great stretch of the imagination to see the immediate

Ross Blunden

usefulness of a comprehensive theory in the prediction of traffic volumes and the design of capacities to accommodate them, in the evaluation of the efficiencies of transport systems, and in the determination of standards of operational control."

The research projects that Blunden initiated at the California Institute concern the application of queuing theory to lane capacity, intersection delay, and parking station reservoir space.

Blunden is an honors graduate of the University of Sydney in both science and engineering (1936 and 1938) and a graduate of the Royal Military College of Science in England (1945), specializing in computers and ballistics. His major research activity has been in connection with the development in Australia of a large-scale electro-mechanical differential analyzer. In addition, he pioneered the application of operations research methods to military problems in Australia.

He is a member of the Institute of Transport and the Institute of Physics, both of London, England, and an associate member of Australia's Institute of Engineering. In the United States, he is an associate member of the ITE.

Job Changes

William A. Dundas—formerly Assistant Traffic Engineer for the County of Contra Costa in Martinez, California; is now Traffic Engineer with the City of Newport Beach, Calif.

Michael T. Gruenbaum—formerly Research Assistant with the Yale Bureau of Highway Traffic in New Haven, Connecticut; is now Principal Transportation Planner with the Boston Redevelopment Authority in Boston, Massachusetts.

Benjamin W. McKay, Jr.—formerly Traffic Control Engineer with the Division of Traffic Engineering in Dayton, Ohio; is now Traffic Control Engineer 4 with the Department of Public Utilities in Cincinnati, Ohio.

George C. Villegas—Director of Public Works in La Verne, California, is now Adviser on Traffic Problems to the Republic of Panama in Panama City under the Bureau of Technical Assistance Operations of the United Nations. He will be in Panama approximately five months and then return to California.

Title Changes

Grant A. Bacchus—is now Traffic Engineer with A. D. Margison & Associates Ltd. in Toronto, Ontario, Canada; was Traffic Planning Engineer.

John F. May—is now Assistant Operations Engineer with the Illinois Division of Highways, Bureau of Traffic in Springfield, Illinois; was Assistant Traffic Engineer.

Yoshiaki Sadai—is now Chief Engineer with the Chugoku Construction Bureau in Izumo, Japan; was Section Chief in Hiroshima.

William A. Stewart—is now head of the Transportation and Municipal Division of A. D. Margison & Associates, Ltd. in Toronto, Ontario, Canada; was Chief Municipal Engineer.

James H. Sumners—is now Assistant State Manager of the Traffic and Planning Division, Mississippi State Highway Department in Jackson, Mississippi; was Office Operation Engineer.

Richard C. Thomas—is now Assistant Traffic Engineer with the City and County of Denver, Department of Public Works in Denver, Colorado; was Traffic Engineer II.

Robert E. Vannice—is now Design Engineer in the Cuyahoga County Engineer's Office in Cleveland, Ohio; was Planning Engineer.

New Publications

Specifications for Control and Protection of Traffic on Construction and Maintenance Projects

Bulletin 43, Traffic Engineering Bureau, Pennsylvania Department of Highways, Harrisburg, Pennsylvania. 1961. 11 pp. 43 drwgs.

This bulletin establishes uniform methods of traffic control at the site of construction and maintenance projects in the State of Pennsylvania, designed to protect both motorists and workmen, and yet allow traffic to move through the project as quickly and safely as possible.

Reflecting the demands of high-volume, high-speed traffic, the bulletin will be of interest to all those having responsibilities in this area. Copies are available for distribution to those requesting them from the Department in Harrisburg.

Traffic Control Manual for Work on City Streets

City Engineering Department, Vancouver, B.C. 1961. 25 pp., 30 drwgs.

This manual has been prepared and issued to provide a uniform standard for traffic control during times when work by city or utility forces is being carried out on city streets. Responsibilities of the city, the contractor, the utility or other agency are outlined, general procedures are established, and specific equipment and personnel are set forth.

The Engineer in State Government

National Society of Professional Engineers, 2029 K. Street NW, Washington 6, D. C. 19 pp. $1.00 (($0.50 to NSPE members).

This report by the Functional Section for Engineers in Government Practice of the National Society of Professional Engineers summarizes a recent study of merit system provisions and personnel policies applicable to engineer employees in state governments. Among the recommendations of the report are those that the states undertake more positive measures to encourage an increase in registration among engineer employees; provide engineers with adequate numbers of supporting technical and clerical personnel; expand the range of assistance provided for advanced technical education; and expand current practices which encourage engineer employees to participate in professional society activities.

Rubber and Tire Friction

H. W. Kummer and W. E. Meyer, Engineering Research Bulletin B-80, 227 Hammond Building, The Pennsylvania State University, University Park, Pa. 96 pp., 54 fig. $3.00.

Effects of pressure or normal load, sliding velocity, temperature, and contaminating and lubricating films on the adhesion and hysteresis components of friction are investigated for the rubber block and the rolling, slipping, and sliding pneumatic tire.

Literature on the behavior of pneumatic tires on dry and wet surfaces is surveyed, and several new or modified explanations are proposed.

Topics given special consideration include:

- The mechanism of rubber friction.
- The questionable existence of a static coefficient for rubber.
- The transient behavior of adhesive friction at non-steady sliding velocities.
- The rise of the sliding coefficient with increased sliding velocity.
- Comparison of coefficients obtained from sliding and slipping tires.
- The meaning of slip.
- The dependence of the critical coefficient on slip and on vehicle velocity.
- Effects of tire geometry, pressure distribution in the footprint, vehicle speed, and water film thickness on the coefficient of road friction.
- The mechanism of water removal between tire and road surface under wet driving conditions.

Experimental methods of measuring rubber and tire friction are reviewed and the Penn State brake test trailer is described.

Metro

American Automobile Association, 1712 G Street NW, Washington 6, D.C. 28 pp. $0.15.

A new brochure, which carries the sub-title "Toward a Brighter Traffic Future for Cities and Suburbs," has just been issued by the American Automobile Association as a part of the AAA's campaign aimed at a solution of metropolitan traffic problems.

The publication has two objectives, according to the foreword: (1) To set forth facts, trends, principles and concepts which will be useful to officials and citizens concerned with urban transportation; and (2) To answer half-truths, mis-statements and distortions of fact being leveled against urban highway transportation.

The brochure outlines in attractive and readable fashion the current metropolitan transportation problem, discusses some of the roadblocks being thrown in the way of a solution, treats the subject of fixed rails and what they can and cannot do, and lists a number of examples of traffic improvements provided by freeway construction and by traffic engineering treatment of existing facilities.

The document will be of interest to all highway and traffic people.

Increasing Traffic Capacity of Arterial Streets

Bulletin 271, Highway Research Board, 2101 Constitution Avenue, Washington 25, D. C. November 1960. 68 pp. $1.60.

This bulletin contains five papers presented at the 39th Annual Meeting of the Highway Research Board, as follows:

"Increasing the Traffic-Carrying Capability of Urban Arterial Streets," by Jack Berman and Arthur A. Carter, Jr.

"Application of Police Power and Planning Controls to Arterial Streets," by William H. Stanhagen and John J. Mullins, Jr.

"Tension Responses of Drivers Generated on Urban Streets," by Richard M. Michaels.

"Capacity of Traffic Signals and Traffic Signal Timing," by W. R. Bellis.

"Report of Committee on Highway Capacity," by O. K. Normann.

VEHICLE SPACING

(Continued from page 18)

to a successful solution is the collection of accurate and adequate data. The data will be stochastic in nature and must be analyzed by statistical methods.

Despite several unsuccessful attempts to secure funds for making a study of traffic flow along the lines of the "idea" outlined, it is believed that such a study will soon be made and that it will yield valuable information. A better understanding of traffic stream behavior will lead to more effective traffic control and to better geometric design of highways to keep traffic flowing more freely.

New Equipment and Methods

Publication of product announcements in this section should not be construed as endorsement or approval by the Institute of Traffic Engineers

Highway Button Light

Button lights were originally developed for use in marking airport runways and taxiways for the guidance of aircraft pilots. The high speeds involved in handling aircraft make it imperative that the pilot be able to discern his path instantaneously and without error.

Night-time highway driving entails the same necessity for speed and accuracy of vision. Sylvania feels that the application of the button light to some roadway delineation problems will provide a contribution to highway safety.

A new catalog sheet describes the highway button light and suggests some situations in which it may be profitably used.

Sylvania will be pleased to cooperate with any interested parties in arranging a demonstration of this innovation.

Sylvania Lighting Products, Special Products Plant, Ipswich, Massachusetts

New Safety-Glo Traffic Clothes

Available in vests, jackets, mitts, and "Sam Brown" belts, Safety-Glo traffic clothes have alternate stripes of fluorescent "flame orange" for maximum daytime visibility and phosphorescent white to make the wearer actually glow in the dark.

During the day, the brilliant orange stripes will command the attention of drivers, while at night, the luminous white stripes, easily activated by headlights or a flashlight, will create their own warning light.

Made of specially-processed cotton drill and vinyl fabric for long wear, the Safety-Glo garments are fitted with elastic panels so that one model will fit nearly all sizes. Prices start at $1.50 for the schoolboy "Sam Brown" belt, and range to $6.90 for the complete Safety-Glo jacket. Designed to be worn over other clothing, Safety-Glo traffic clothes are available in "ventilated" styles with hundreds of tiny ventilation holes to provide policemen, road workers, schoolboy patrols, hunters—anyone whose safety depends upon his visibility—with comfortable safety.

A free catalog printed in Safety-Glo colors is available.

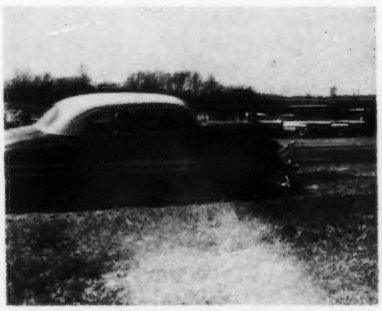
Eastern Metal of Elmira, Inc., 139 Grand Central Ave., Elmira Heights, N. Y.

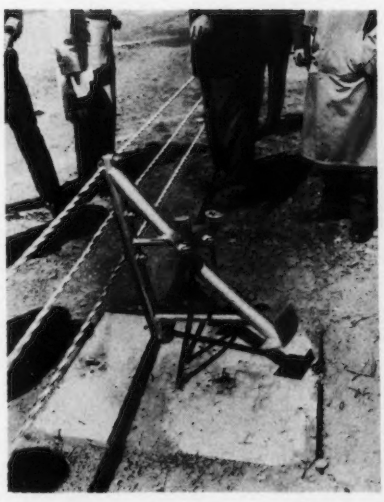
Flexible Guard Device Tested

An automobile driven by a test driver traveling at 55 miles an hour crashed into the new Flexible Highway Guard at a demonstration in Berlin, Wisconsin, witnessed by highway and safety officials from three states. The new highway guard is manufactured by the Berlin Chapman Co. also of Berlin.

It differs entirely in the construction from the usual highway guard rails in that the cable supporting posts are not rigid. They actually move under impact on their respective bases to cushion the shock of impact and yet provide fully adequate resistance . . . to absorb much of the force of the speeding automobile. The driver in the demonstration which was conducted at speeds of 35, 45 and 55 miles an hour and later on a curve, was not hurt.

The cable supporting units may be spaced at 25, 30, and 35 foot intervals, although the test was a complete success at 35 foot intervals on the roadway where the above test was conducted.





The second illustration shows the cable supporting units after being hit by the car, which were later reset by workmen using a wrench and pinch bar. Due to its steel construction the Flexible Highway Guard is practically indestructible.

Berlin Chapman Co., Berlin, Wis.

Durant Highway Load-Limit Scale

The large, easily visible figures of a Durant Model "Y" digital readout counter provide fast and accurate readings on a portable highway load limit scale.

Called the "Loadometer", and manufactured by the Loadometer Corporation of Baltimore, Md., the compact and completely portable scales are designed to weigh all types of trucks, busses, trailers and other highway vehicles. The rugged Durant counter gives continued dependable service, despite repeated shock and impact of heavy-duty highway use. The counter is designed to make quick adjustments to the scales' balance readings as well as for ease of calibration.

By having exact numerical readings before them, rather than having to interpret a line gauge, busy highway officials find it easier than ever before to "Weigh the loads and save the roads."

The model "Y" is one of the full line of counting and measuring instruments manufactured by Durant for adaptation as integral parts of a wide variety of machinery.

Full details on this and other counter applications may be obtained by writing to Durant Manufacturing Company, Dept. TE 1900 North Buffum Street, Milwaukee 1, Wisconsin.

New Look for Muni-Quip Radar Timer

The Muni-Quip Corporation of Decatur, Illinois, one of the oldest manufacturers of speed timing equipment, has introduced a new look for their Radar Timer. The new model is the 304A Radar Timer. The amplifier-power supply case only measures 10 1/4 inches wide, 5 5/8 inches high and 10 1/8 inches deep. Total weight is just twelve pounds with vibrator supply or eight and one half pounds with transistor power supply. The antenna is the time proven "Rabbit Ears" that offers flexibility in mounting and can be used on the spotlight arm, window or door bracket, seat bracket or floor mount. This versatility of mounting, either inside or outside the car gives the user year round operation regardless of the weather.

Cars can be timed from 600 feet right to the check car. Trucks and buses can be timed up to 1,500 feet away. The Muni-Quip Corporation Model 304A Radar Timer is a rugged speed timing device incorporating all the latest technical features necessary in a reliable radar timing device.

For more information or a free demonstration, write or call collect the Muni-Quip Corporation, 989 West King Street, Decatur, Illinois.

New Control Concept

A radically new concept of traffic signal control which can save upwards of $2 million a year in driving costs plus $20-$40 million in road construction costs and possibly slow the move of city industry to the suburbs has been proved successful following pilot operation at Toronto. Even higher cost savings may be possible in bigger cities in the U. S., research engineers say.

The system reduces congestion and delay in city streets by operating traffic signals under the control of a centrally located high speed digital computer. The system was conceived and developed by the Traffic Research Corporation under instructions from the Traffic Engineering Departments of the City of Toronto and the Municipality of Metropolitan Toronto. The scientific firm that did the work has bases both in Toronto and New York.

Report of the successful pilot test was made by the research company's chief engineer, Leonard Casciato and President Dr. Josef Kates. Mr. Casciato, who headed the engineering team that proved the concept successful, told the city's engineers that "Not only has delay and congestion been reduced, but a new level of scientific knowledge has been broached so that even better plans can be made for the future." An important by-product was new data on traffic characteristics that will be valuable for long range traffic planning.

The 20-month pilot study was described by the engineers as "a technical and operational success".

Major advantage of the computer-control system is its flexibility. The test system could duplicate the performance of any combination of the most advanced forms of traffic signal equipment currently available anywhere in the world. It tests the strengths and weaknesses of each known system. In addition, however, it has one feature exclusively its own: the capacity to sense and react to congestion—the first time ever that a traffic signal system has been able to sense and then do something about congested traffic on city streets.

The system works like this: a vehicle detector counts vehicles approaching a busy intersection and transmits its count to the computer. Every two seconds the computer measures the flow of traffic toward and through the intersection and then decides whether to extend or change the green-red pattern. Traffic Research Corporation engineers have been able to so stimulate the machine's "memory" (magnetic-core storage serviced by tapes) that it can trace hundreds of platoons of vehicles through city travel corridors—and give each of them the best possible light treatment consistent with the overall need for good traffic control.

The system worked so well in pilot operation that traffic volumes could have been increased 20% without need for increased street capacity and even better results are expected in the future. This improvement, Mr. Casciato pointed out, was achieved while the system "is developed only to an intermediate stage of efficiency."

The Traffic Research Corporation engineers who devised the system have revealed that the so-called "Toronto system" can be used anywhere in North America with minor modifications to the computer program and to the local traffic signal system. Its flexibility is such that it can be tied into all known traffic patterns.

In the formal report presented, the traffic research specialists outlined that Toronto averages an estimated 50,000 vehicle hours of delay in morning and evening rush hours each weekday—and that this is rated as an out-of-pocket cost for engine wear, gasoline, etc. at 90 cents per hour, exclusive of driver time. "We could expect a reduction in total traffic delay exceeding 9,000 hours daily. On a five day week this is $2 million per year, in vehicle operating costs alone," the report outlined. It added, "To industry, the cost of delay is several times as great and is one of the reasons for the flight to the suburbs."

The big savings, however, would be in capital costs by postponing the necessity for new street building or street widening. The traffic scientists have discovered that for a city the size of Toronto (population 1.5 million) every 1% increase in street carrying capacity would cost between $2 and $4 million to achieve via new construction.

The report on the pilot test showed that the full system covering some 500 intersections could be installed for about $3 million.

Traffic Research Corporation, 20 Spadina Road, Toronto 4, Ontario, Canada and 10 Columbus Circle, New York City, N. Y.

Holophane Announces Booklet

"Design and Application of Holophane Prismatic Street Lighting Refractors" is a 24-page booklet now available to City Engineers, Superintendents and Public Works Departments, Utilities and Consulting Engineers. The illustrated book presents design considerations and application information based on years of field experience.

Section One is devoted to color line sketches illustrating basic prismatic principles, vertical and lateral distributions, open bottom type one piece refractor, and refractors for fluorescent lamps.

Section Two includes a complete listing of refractor illustrations each with its specific basic-type light distribution for filament, vertical and horizontal mercury and fluorescent lamps ranging from 100 watt vertical mercury to 15,000 Lumen Filament and 1,000 watt Horizontal Mercury Lamps.

Applications vary from residential streets to highways, thruways, expressways, bridges and main business streets. Holophane Refractors are sold for luminaires of leading manufacturers of street and highway lighting equipment.

Holophane Co., Inc., 342 Madison Avenue, New York 17, N. Y.

Technical Notes

AN INFORMATIONAL REPORT ON SPEED ZONING

This report was approved by the Technical Council of the Institute of Traffic Engineers on April 28, 1961, for publication as an informational report. It was developed over a period of years by Technical Committee 3-C of the Institute, under successive chairmanships of J. E. P. Darrell, Harold G. Eckhardt and William L. Carson, with further revisions by the Technical Council.

It is the belief of the Technical Council that this report presents a valid statement of speed zoning principles and of the factors to be recognized in their application. While the degree of validity attached to all of the items mentioned in the report has not been established through use, speed zoning experience to date indicates that each of the individual checks suggested is just and proper. Additional research through controlled application of these checks is needed in urban, rural and intermediate areas to determine more fully their validity and usefulness.

Why Control Speed?

The operation of any motor vehicle involves the element of speed. For a given road or street, a speed that is proper at one time may be grossly improper at another time because of changed conditions. The maximum safe speed at any location will vary as traffic, road, weather, light and other significant conditions change. Speed excessive for prevailing conditions, rather than high speed per se, is thus the principal factor to be considered in controlling maximum speeds of vehicles for improved traffic safety. An unsafe speed can actually be a very low one in terms of miles per hour, while relatively high speeds can be safe under favorable circumstances. Although accidents involving high vehicle speeds tend to be serious ones, some of the lowest fatal and non-fatal traffic accident rates are found on highways carrying traffic at high average speeds.

Scientific control of speed is important to both the safety and efficiency of traffic movements. It is advisable, therefore, that the authority and responsibility for speed zoning be delegated to traffic engineers and that determinations of speed control measures be on the basis of an engineering study and investigation. Although its effect is difficult to determine exactly, proper speed zoning can improve both the overall safety and efficiency of traffic flow—intrinsic elements of traffic engineering.

As is true in other aspects of traffic control, it is highly desirable that there be uniformity in the fundamentals followed in speed regulation. The meaning of speed limits, the principles and practices followed in their application and the requirements placed upon drivers who must observe them, should be consistent among various jurisdictions. This does not prevent adapting specific speed limits to conditions existing at the locations involved.

Interest in the improvement and standardization of speed zoning practices and in the development of warrants for zoning extends over a number of years. Various committees in a number of organizations have attempted to collect, analyze and summarize information from available sources with the hope of developing effective zoning techniques and of providing persons responsible for speed control measures with some helpful guides and basic rules. Nothwithstanding this general interest and endeavor, there is still no generally accepted standard, and practices in states and cities continue to vary.

Speed Control Laws

While there is considerable variance among states and municipalities as to the extent and nature of their speed regulations, there are three principal types of speed control laws:

1. *Basic Speed Rule.* Every state has a statute covering what is known as the "basic speed rule". The substance of such laws is that a driver shall always operate his vehicle at a speed that is reasonable and prudent under existing conditions, taking due account of all actual and potential hazards. In a few states this is the only general speed law governing daytime passenger car travel on rural highways.

2. *Prima Facie Speed Limits.* The basic speed rule is supplemented in almost one-half of the states by laws establishing, and/or providing for the establishment of, prima facie speed limits. This type of speed control law provides that any vehicle speed in excess of the established numerical limit is prima facie evidence that the driver is not operating his vehicle at a reasonable and prudent speed. Such laws give a person arrested for violating a speed limit the right to prove that the speed at which he was driving was not improper under existing conditions. Thus, prima facie limits allow for the fact that no particular rate of speed is necessarily safe or unsafe at all times. Principal disadvantages of this type of speed limit are that its meaning often is not understood, and enforcement is comparatively difficult.

3. *Absolute Speed Limits.* In just over half the states the basic speed rule is supplemented by laws establishing, and/or providing for the establishment of absolute (or fixed) speed limits. It is illegal to exceed speed limits of this type under any condition at any time. No determination is left to police or judicial officials as to whether or not the driver was proceeding at a safe speed when he exceeded the speed limit.

Advantages of absolute speed limits include their definiteness of meaning and the comparative ease with which the conviction of violators may be secured. Absolute speed limits tend to be set somewhat higher than prima facie limits as a result of their nature and requirements.

The nature and provisions of speed laws vary widely among states. Predominant speed limits are 60-65 miles per hour for daytime passenger car travel on rural roads, 25-30 miles per hour in residential districts, and 20-25 miles per hour in business districts. Over thirty states have established lower daytime speed limits on rural roads for trucks, while almost twenty states have reduced speed limits for nighttime travel. About half of the states now have laws providing for the establishment of minimum speed limits, and this type of speed control is being utilized on certain roads and

streets in about one-fourth of the states.

Although all states and the municipalities of all but a few states have some type of speed zoning authority, extensive differences exist in the degree and character of such authority. This is particularly true with regard to the respective responsibilities of states and municipalities in the establishment of speed limits on state highways in urban areas.

It is evident that no common pattern for speed regulation exists on the basis of current laws. It should be noted, however, that an increasing number of states and municipalities are adopting speed control laws with provisions that are consistent with those set forth in the Uniform Vehicle Code (Article VIII) and the Model Traffic Ordinance (Article V).

Speed Zoning

The speed laws set forth in the previous section cannot possibly cover every condition to be found on all the streets and highways of a state or city. Therefore, it becomes necessary in many instances to modify the speed limits set forth in the statutes.

As used in this report, speed zoning will be defined as the process of determining whether or not the statutory limit is appropriate for a section of roadway and, if not, what the appropriate maximum speed limit should be. Only maximum speed limits will be discussed—minimum speed limits are considered to be a related but separate topic.

Basic Principles

The following basic principles relative to speed control and zoning have been evolved from speed zoning programs and studies:

1. Speed control is an important element in traffic movement and regulation.

2. Not all streets and roads need to be zoned for speed. The average driver will not submit voluntarily to needless speed restriction. Over-emphasis in the application of speed zoning will decrease the degree of observance of speed regulations in the same manner that excessive or unwarranted applications of other types of control measures tend to decrease the quality of observance.

3. Speed zoning always should be on the basis of a traffic engineering study. No one is qualified to arbitrarily establish a proper speed limit without the benefit of engineering information and data. The utilization of engineering principles and procedures in vehicle speed control will improve traffic operation, encourage better and more uniform driving practices, and increase the safety of traffic movement. Speed zoning should never be applied merely for restrictive purposes.

4. The number and type of factors that must be taken into account in speed zoning will depend to some extent upon the facility and location involved. The factors deserving close attention in the establishment of speed limits on conventional city streets, for example, may not be the same as those to be considered in determining speed limits on rural expressways.

5. The maximum safe speed at any location will vary as traffic, weather, light, pavement surface, and other conditions and factors change.

6. Speed limits must be reasonable if their potential value is to be realized. An unrealistic limit is usually worse than no limit. Unrealistic speed limits often cause an increase in intervehicular collisions or induce other problems. In some cases where careful before and after studies have been made it has been shown that traffic accident rates have been reduced by raising or lowering a speed limit to a realistic level.

7. Speed limits are of little value unless observed. Rarely can they be enforced if established below what the majority of drivers consider to be a reasonable limit. The preponderant majority of drivers travel at a reasonable and safe speed. Their speed selections establish the speed pattern and give an unmistakable indication of the desirable and enforceable speed limit for the section of highway involved.

8. The posting of the appropriate regulatory signs is important to the effectiveness of speed zoning. The design, use and placement of such signs should be uniform and in conformity to the provisions of the Manual on Uniform Traffic Control Devices.

Factors to be Considered

There are certain factors that should be reviewed in any study to ascertain the advisability of establishing a speed zone and the maximum speed limit to be applied therein or modify the speed limit in an existing speed zone. While the relative importance of these factors and the degree to which some of them should be investigated will vary from one location to another, each needs to be considered if the study is to provide a sound basis for speed regulation.

1. Prevailing Vehicle Speeds

As previously noted, speed limits must be generally consistent with speeds that drivers feel are safe and proper if speed zoning is to prove effective. The prevailing speeds of traffic on the section of highway involved are the most important, though not

necessarily the determinative, factor in speed zoning. To a considerable extent, driver-selected speeds reflect the other factors involved in speed zoning. Since they are so-influenced, actual vehicle speeds constitute an index of most of the elements to be considered in a specific speed zoning project. Unless the accident experience, or some other circumstance unknown or not evident to most drivers is critical, prevailing speeds can be used reliably as the principal basis in speed limit determinations. The speed zoning procedure should, however, include an analysis of the various elements affecting safe speeds and a judgment as to whether or not they require a speed limit different from that based on prevailing vehicle speeds.

Three measures of actual speeds are:

a. 85 Percentile Speed[1]

The criterion most generally used and preferred in determining the specific maximum speed limit from speed studies is the 85 percentile speed—the speed at or below which 85% of the vehicles travel—determined from spot speed studies. Numerous and extensive "before-and-after" studies have substantiated the general propriety and value of this criterion, and it is being utilized increasingly in the speed zoning programs of states and municipalities.

b. Pace[1]

Another criterion that has been used successfully in selecting a proper maximum speed limit, usually in conjunction with the 85 percentile speed, is the "pace". The pace is that range of speed, generally a 10 miles-per-hour range, in which more vehicles travel than in any other like range of speed. It also can be determined from spot speed studies.

c. Average Test Run Speed[2]

Unlike the two previous studies which determine motor vehicle speeds at selected locations, a test run can be used to determine speeds along an entire route. Such information is useful as a check on the spot speeds and in determining the break points for changes in speed limits.

2. Physical Features

The physical features of the section of highway should be considered in determining whether or not a speed zone is desirable, and if so, what the numerical limits should be.

These features group themselves in several categories as follows:

a. Design Speed

The design speed of a highway is that speed at which vehicles can travel during times when the design of the highway is the controlling factor. If at all possible this speed should be determined for the section of highway being studied.

When a new highway is built the design speed will determine the values used for the following features: 1) Widths of roadways, lanes and shoulders; 2) Degree and superelevation of curves; 3) Length and steepness of grades; 4) Sight distance required for safe stopping and passing.

A study of these factors on the plans from which a highway was built may reveal the design speed used. On the other hand plans for many old highways are no longer available or were built to standards now obsolete. If this is the case the measurable physical features described below offer a guide to the appropriate maximum speed which should be allowed.

b. Measurable Physical Features

The features outlined below may be measured in the field. An evaluation of these will provide an indication of whether or not the speed limit determined under "1" is acceptable for the section of highway being studied.

1) Maximum comfortable speed on curves.

This speed is determined by use of a ball bank indicator.[3]

On roads with many curves the speeds determined in this manner may determine the speed limit. For isolated sharp curves Advisory Speed Signs which are *not* speed limits will generally be used.

2) Spacing of Intersections

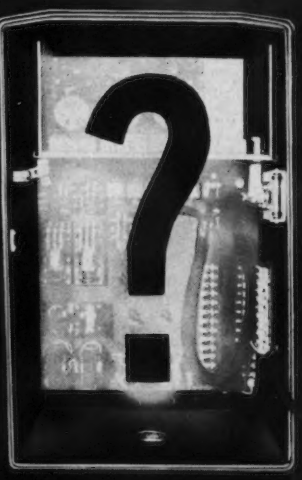
Roadways with many intersections require lower speed limits because of the increased number of potential conflicts. The relationship of these to the appropriate speed limit is indicated on

1. For information on how to make studies to determine "85 Percentile Speed" and "Pace" see the TRAFFIC ENGINEERING HANDBOOK and/or the MANUAL OF TRAFFIC ENGINEERING STUDIES.

2. The average test run speed is most simply determined by using a passenger car with a calibrated speedometer from which the speed is recorded at 0.1 mile intervals over the length of the highway being studied. Runs are made under light traffic conditions to insure that the conditions of the road and its environment govern the driver's speed rather than traffic conditions. Two runs in each direction are generally sufficient.

3. The maximum speed at which a curve may be traveled comfortably is indicated by a reading of 10° on a ball bank indicator. The speed at which the ball bank indicator reads 10° is determined by several passes in each direction with a test car.

MARBELITE'S M-35 SVAP
is a very special Vehicle and Pedestrian Semi-Actuated Controller



WHAT makes it special?

HOW does it work?

WHERE is it used?

get the answers, write today- for complete, newly published manual!
THE MARBELITE CO., INC.
175 NORTH 10th STREET
BROOKLYN 11, N.Y.

the "Check Sheet for Speed Zones". Public roads intersecting the roadway being studied are considered to be intersections.

3) Number of Roadside Businesses per Mile

Business establishments with access increase the roadside friction encountered by traffic using a highway. (Residential driveways do so also but to a much lesser degree.) The relationship of these to the appropriate speed is indicated on the "Check Sheet for Speed Zones".

c. Roadway Surface Characteristics and Conditions

The maximum safe speed for a particular highway or street will be affected by the surface conditions of the roadway. It is not possible at the present time to specify how much a speed limit should be lowered when one or more of the factors listed below are adverse. Also some of these factors are subject to change depending on weather conditions or time of year. Nevertheless, the following factors should be reviewed when a judgment is made on whether or not a proposed maximum speed limit is appropriate.

1) Slipperiness of pavement; 2) Roughness of pavement; 3) Presence of transverse dips and bumps; 4) Presence and condition of shoulders; 5) Presence and width of median.

Particular care should be taken to see whether or not these factors are reflected in the speed studies made.

3. Accident Experience

Accidents are a primary generator of public demands to establish or lower speed limits. Common assumptions among lay persons are that the lowering of the speed limit will reduce vehicle speeds and that slower vehicle speeds will result in fewer accidents. There is much evidence that neither of these beliefs necessarily holds true. On the other hand, collision frequencies and accident rates have been reduced by raising speed limits to realistic levels.

Despite the present inability to foretell the exact effect a particular speed limit will have on accidents, the accident record of the section of road being considered should be reviewed. The review should encompass a check of the frequency, severity, type and cause of accidents occurring on the section of highway involved—*with particular attention to those accidents in which unreasonable speeds appear to have been a causative or severity factor*. Where adequate data are available, insight into the overall operation of traffic can be gained from such a study. Furthermore an opportunity is provided for before and after study of the influence of a realistic speed limit on the accident picture.

4. Traffic Characteristics and Control

Account should be taken of any traffic characteristics, conditions, or controls that are present on the section of roadway being studied. Again it is not possible at present to determine the exact effect of these factors. However, the following factors should be considered when determining the appropriateness of a proposed speed limit.

a. Traffic volumes, both off-peak and peak, as related to highway capacity, density and headways. Speed differentials may not be objectionable on low volume highways, but they become more hazardous as volumes increase.

b. Parking, loading and other vehicle operations adjacent to travel lanes.

c. Commercial vehicles in traffic stream.

d. Turn movements and controls.

e. Traffic signals and other control devices or systems that may importantly affect or be affected by vehicle speeds.

f. The extent and frequency of vehicle-pedestrian conflicts considering pedestrian movements alongside the pavement as well as to those made across the highway.

In regard to pedestrians, speed restrictions which are otherwise unwarranted should not be established for pedestrian protection if vehicle-pedestrian interferences can be treated successfully by physical separation or by other types of control measures. Speed limits alone seldom can improve a pedestrian safety problem.

Area Speed Limits

It is frequently advisable to establish speed limits on an area basis rather than on an individual highway basis. Many jurisdictions have laws setting forth specific speed limits on all roads and streets in areas or districts of a particular class. Localities where speed zoning of this nature often is desirable include: 1. Business and commercial districts; 2. Residential districts; 3. Industrial areas; 4. Large school and other public institution areas; 5. Park and recreational areas; 6. Public assembly areas; 7. Areas of much more intense development than surrounding or adjacent districts.

Drivers will expect and accept greater speed restrictions in the above areas. The factors to be considered in speed zoning on an area basis are identical to those used in speed zoning along individual highways. However, the elements and conditions involved will naturally vary within the area, and more judgment will be required in order to determine a speed limit that is proper for the area as a whole. Such speed limits should not preclude the establishment of higher or lower speed limits on individual streets within the area as warranted. The presence of a school, health institution, series of roadside establishments, etc. may be factors which will merit individual consideration.

When speed limit selections are affected by the type of locality or place involved, it is advisable to consider whether or not the speed restrictions need to be in effect at all times or only during certain seasons or times.

Evaluation of Need For A Speed Zone

Locations where there is a need for a speed zone will probably become apparent to the engineer initially because one of the following conditions exist:

1. A road or street has design standards considerably higher or lower than those of most other highways in the state or community involved.

2. The roadway is a transitional stretch of highway between sparsely developed and highly-built-up areas.

3. The roadway has sections on which unusual conditions exist or other factors are present which make it advisable to establish speed limits different from those applicable under general laws.

The above listed items are mainly intuitive on the part of the engineer—being in large measure a molding together in his mind of all the principles and factors previously discussed. Most of these factors cannot be isolated and measured individually. However, study has revealed that several of the factors which are measurable reflect the need for a speed zone.

It is impractical to change posted speed limits at intervals of less than 1,000 feet. This element is reflected in the minimum length of a speed zone which is permitted with the length in-

HERE'S THE

NEW ROCKWELL M-3 PARKING METER

with all new, stainless steel "guts" for trouble-free operation and it takes 5 coins through a single slot.

If you want manual meters, check these features that will assure you better traffic control at far lower cost:

- **Single Coin Slot** takes 1¢, 5¢, 10¢, 25¢, and tokens.
- **Stainless Steel** working parts resist wear —stop corrosion.
- **Greater Visibility** with new, big violation flag . . . easy to patrol.
- **Easily Accessible:** entire mechanism exposed with turn of the key.
- **Interchangeability:** "unitized" door and mechanism fit Dual automatics.
- **Tamper-proof** design rejects paper clips, etc.—gearing completely protected.

And the famous Dual tradition of rugged construction and clean, simple design that has made Dual the leader in metered traffic control devices.

The new Rockwell-built Dual Manual Parking Meter makes the line more complete than ever before. No matter what your needs, no matter what your preferences, there is a Rockwell-built Dual Manual, Automatic or Twin-Dual Automatic to help you get better traffic control, increase parking meter revenue and slash maintenance costs. Write for complete details: Dual Parking Meter Company, Subsidiary of Rockwell Manufacturing Company, Pittsburgh 8, Pa.

A few turns of key exposes mechanism for fast, easy maintenance. Dust-proof housing covers brass clock works.

See how the new violation flag is more easily seen . . . this meter has 3-way out-of-order signal.

DUAL PARKING METERS

another fine product by

ROCKWELL

CHECK SHEET FOR SPEED ZONES

(PART I)

Highway Conditions (3 or more must be satisfied)				Preliminary Estimate of Maximum Speed Limit
Design Speed	Minimum length of proposed zone equals or exceeds*	Average distance between intersections equals or exceeds	Number of roadside businesses (with access) does not exceed	
MPH	MILES	FEET	PER MILE	
20	0.2	No Minimum	No Maximum	20
30	0.2	No Minimum	No Maximum	30
40	0.3	125	8	40
50	0.5	250	6	50
60	0.5	500	4	60
70	—	1000	1	70

*Consideration is to be given to the number of isolated sharp curves which require posting with Advisory Speed signs. If sharp curves occur at intervals of less than these figures, the speed limit may be determined by the curves.

(PART II)

Speed Pattern (2 or more must be satisfied)			Maximum Proposed Speed Limit
"85 percentile speed" between	Both limits of "Pace" between	Average test run speed equals or exceeds	
MPH	MPH	MPH	
under 22.5	under 25	17.5	20
22.5 - 27.5	11 - 29	22.5	25
27.5 - 32.5	16 - 34	27.5	30
32.5 - 37.5	21 - 39	32.5	35
37.5 - 42.5	26 - 44	37.5	40
42.5 - 47.5	31 - 49	42.5	45
47.5 - 52.5	36 - 54	47.5	50
52.5 - 57.5	41 - 59	52.5	55
57.5 - 62.5	46 - 64	57.5	60
62.5 - 67.5	51 - 66	62.5	65
67.5 - or over	over 55	67.5	70

creasing as speed increases. (Part I of "Check Sheet")

The first part of the "Check Sheet" which follows will help the engineer to make an evaluation of the measurable conditions along the highway being considered for speed zoning. If three or more of the conditions stated are met, a speed zone which has a maximum limit as indicated may be appropriate. The value of the maximum limit thus determined *is only a preliminary estimate.* The actual speed pattern must be measured in the field and the conditions set forth on the second part of the "Check Sheet" must be met.

Value of the Speed Limit

Measurement of the actual vehicular speeds is a necessary part of the determination of the speed limit which is to be set. Spot speed studies are made to determine the "85 percentile speed" and the "pace". Then as a check on the speed values thus determined, the "average test run speed" should be found.

Both the "85 percentile speed" and the "pace" are fundamental criteria in determining the proper numerical value of maximum speed limits. Maximum speed limits based on these criteria are usually reasonable by any standard, relatively easy to enforce, normally successful in obtaining a high degree of voluntary observance by motorists, effective in limiting the excessively fast drivers without placing unnecessary restrictions on others, and conducive to smoother traffic flow—mainly through reductions in passing maneuvers.

The upper limit of the "pace" usually approximates the "85 percentile speed" and is seldom above or much below it. The establishment of a maximum speed limit lower than the "pace", or substantially below the "85 percentile speed", frequently has resulted in a reduction in the percentage of vehicles traveling within the "pace". For this reason, the maximum speed limit selected should not be more than 3 miles per hour below the upper limit of the 10 m.p.h. "pace" or the "85 percentile speed" whichever is the lower, unless some compelling circumstance exists.

When the above values have been determined a more accurate estimate of the speed limit to be set can be found by entering the second part of the "Check Sheet". The speed limit which satisfies two or more of the conditions mentioned is the limit which should be set for the speed zone.

Only under the most extenuating of circumstances should a speed limit be set lower than the one determined above. Any alteration of the limit should be based on the professional judgment of the engineer who fully understands the interrelation and interaction of the many as yet unmeasurable factors involved in speed zoning. In most instances, however, the maximum limits determined by making the studies listed on the "Check Sheet" are practicable and present a sound basis for speed zoning.

Conclusion

Vehicle speed control is an important factor in the safety and efficiency of traffic movements and should, therefore, be of professional concern to traffic engineers. An engineering approach, utilizing proven speed zoning practices, is needed in determining reasonable and proper speed limits for roads and streets. Periodic reevaluation of speed limits and their propriety is advisable, particularly when there are major changes in the factors affecting safe vehicle speeds.

SELECTED REFERENCES

1. Baerwald, J. E. "Theory of Speed Zones in Developed Areas," **Traffic Engineering**, December, 1957, p. 20.
2. **Correlation of Accidents to Speed Zoned Areas on Rural State Highways**, Ohio Department of Highways, 1956.
3. Crowther, R. F. and Shumate, R. P., "Sampling Design for Fixed-Point Speed Measurements," International Association of Chiefs of Police, 1960.
4. Henberger, J. C., Matyas, C. A., & Wiley, C. C., "Effect of Speed Limit Signs on Vehicular Speeds," University of Illinois, 1949.
5. Kessler, W. L., "Effect of Speed Zone Modifications Occasioned by the Illinois Speed Law," **Traffic Engineering**, July, 1959, p. 18.
6. **Manual of Uniform Traffic Control Devices**, State of New York, 1958, Section 25.
7. Matson, T. M. Smith, W. S., & Hurd, F. W. **Traffic Engineering**, 1955, p. 250-259.
8. May, A. D., Jr., and Wagner, F. A., Jr. "Volume and Speed Characteristics at Seven Study Locations," presented at 39th Annual Meeting, Highway Research Board, 1960.
9. McMillan, Claude R., "South Carolina's new (Minimum) Speed Law," **Traffic Quarterly**, October, 1957, p. 492-500.
10. Mohr, H. W. "Principles and Establishment of Speed Zoning in Wisconsin," Presented at University of Wisconsin Engineering Institute, 1957, (mimeograph)
11. **Motor Vehicle Speeds: Annotated**, Highway Research Board Bibliography No. 27, 1960.
12. **Motor Vehicle Speed, Its Control and Regulation**, American Automobile Association, 1959.

13. **Planning Manual of Instructions, Part 8, Traffic,** California Division of Highways, 1960, Sec. 8-703.
14. "Policies and Procedures for Establishing Speed Limit Zones on Streets and Highways," Illinois Division of Highways, 1957 (mimeograph).
15. Shumate, R. P., "The Long Range Effect of Enforcement on Driving Speeds," International Association of Chiefs of Police, 1960.
16. **Speed Regulation,** A report of the Committee on Speed, National Safety Council, 1958.
17. **The Federal Role in Highway Safety,** House Document No. 93, 86th Congress, 1st Session, 1959, p. 72-77.
18. **Traffic Engineering Handbook,** Institute of Traffic Engineers, 1950, p. 378-393.
19. **Traffic Manual,** Minnesota Highway Department, 1960, Section 5-991. 600.
20. Wenger, Deane M., "Effects of Revising Urban Speed Limits," St. Paul, Minnesota Dept. of Public Works, 1960 (mimeograph).
21. "What Should the Maximum Speed Limit Be?" Chicago Motor Club, 1956.

Participating Organizations—1961

The following organizations have contributed to the Technical Development and Research Fund of the Institute of Traffic Engineers in 1961, and have therefore been designated by the Board of Direction as "Participating Organizations" as provided in Section 2 of Article XI of the By-Laws:

Aluminum Company of America
1501 Alcoa Building — Pittsburgh 19, Pa.
R. G. St. John, Representative

American-Marietta Company
3400—13th Avenue S.W. — Seattle 4, Wash.
Tom F. Kelly, Representative

American Transit Association
355 Lexington Ave. — New York 17, N. Y.
George W. Anderson, Representative

Automatic Signal Division Eastern Industries, Inc.
Regent Street — East Norwalk, Conn.
Paul L. Green, Representative

J. E. Bauer Company
1021 N. Mission Road — Los Angeles 33, Calif.
Roy Meggison, Representative

Cataphote Corporation
2505 Albion St. — Toledo 10, Ohio
C. E. Searight (P.O. Box 2066, Jackson, Miss.) Representative

The Clinton Company
1210 North Elston Ave. — Chicago 22, Ill.
Richard H. Clinton, Representative

Crouse-Hinds Company
Wolf & Seventh North Streets, Syracuse 1, N.Y.
K. C. Eichelberg, Representative

Duncan Parking Meter Division of Nautec Corporation
835 North Wood Street — Chicago 22, Ill.
R. J. Smott, Representative

Econolite Corporation
8900 Bellanca Ave. — Los Angeles 45, Calif.
Aubrey Matthews, Representative

Flex-O-Lite Manufacturing Company
P.O. Box 3066 (Affton Br.) — St. Louis 23, Mo.
Charles R. Dernbach, Representative

General Railway Signal Company Electronic Control Division
P.O. Box 600 — Rochester 2, N. Y.
Jerome O'Neill, Representative

Kar-Trol Signal Company, Inc.
12739 South Main — Houston 35, Texas
Jack Hulett, Representative

Magee-Hale Park-O-Meter Company
P.O. Box 7247 — Oklahoma City 12, Okla.
Walter N. Howe, Jr., Representative

(Continued on page 52)

Technical Council News

Technical Council Meets In Washington

The Technical Council met in Washington on April 28 and 29. The following brief statements indicate the Council's action on important points of general interest.

1. Mr. Robinson, Chairman of the Technical Sessions Committee, reported that the program for the Annual Meeting was set except for one spot where delays in replies to invitations were being experienced.

The Chairman also noted that Wednesday morning, August 23, has been set aside for committee meetings of all kinds. To the extent possible, scheduled meetings will be published in the Annual Meeting program.

2. The Council took action on two reports as follows:

a. Approved for publication as an informational report the material developed by former committee 3C and revised by the Council on speed zones. The report now titled "An Informational Report on Speed Zoning" appears elsewhere in this issue.

b. Received the report "Evaluation of ONE WAY, YIELD and DO NOT ENTER Signs" by the Metropolitan (N. Y.) Section and decided to forward it to the Research Sub-Committee of the National Joint Committee on Uniform Traffic Control Devices.

The Council commended the section for this activity in the technical area.

3. Several new project committees were approved for the 1961-62 committee year. These appeared in the June issue.

4. A policy to review every 5 years the "Standards" developed by the ITE was adopted. The people using the present standards (Technical Reports, 1, 2, 3 and 4) are encouraged to submit to ITE Headquarters suggestions for improvements whenever these become apparent during use.

5. The manual of the Technical Council entitled "The Technical Division—Objectives, Membership, Operation" was distributed to the members. Persons interested in the operation of the Council may obtain copies of the manual by writing ITE Headquarters.

6. The Council decided to hold their next meeting during the Annual Meeting in August.

Positions Available

REGIONAL PLANNING COMMISSION NORFOLK, VIRGINIA

Position: Transportation Engineer, to work on the first joint highway and urban planning project of the Housing and Home Finance Agency and the Bureau of Public Roads.
Requirements: College degree in traffic and transportation engineering or two years of college plus experience in transportation engineering.
Salary: Open.
Apply: Garland A. Wood, Southeastern Virginia Regional Planning Commission, 300 Boush Street, Norfolk 10, Virginia.

FRESNO, CALIFORNIA

Position: Assistant Traffic Engineer, to assist in Advanced Planning and Transportation Study.
Requirements: Graduation in engineering, plus three years of traffic experience; or graduation in engineering, an advanced degree or certificate in traffic engineering, plus one year of traffic experience. Written exam will be given.
Salary: $690 to $838.
Apply: Personnel Department, City Hall, Fresno, California.

ANCHORAGE, ALASKA

Position: City Traffic Engineer, to serve as division head of Public Works Department in growing city of 45,000.
Requirements: Qualified man to be responsible for design and installation of all control devices, maintenance and review of accident reports, improvement of traffic flow and parking, and to serve as secretary to the parking commission.
Salary: $790 to $925.
Apply: Robert B. Smith, Director of Public Works, 803 Fifth Avenue, Anchorage, Alaska.

NY STATE CITIZENS' COUNCIL ON TRAFFIC SAFETY

Position: Associate Director.
Requirements: Traffic engineering background preferred; needs public relations ability to meet and discuss traffic safety problems with business and civic leaders.
Salary: $10,000 to $12,000, depending upon experience.
Apply: New York State Citizens' Council on Traffic Safety, Inc., Room 150, 140 West Street, New York 7, N. Y. Phone: BA 7-1234.

NEW YORK STATE

Position: Traffic Engineer for traffic and planning work on diverse Civil Engineering projects of consulting engineering firm with headquarters in New York City.
Requirements: Graduate Civil Engineer with education or appropriate experience in traffic engineering. Applicant should have an interest in learning new subjects, analyzing complex problems effectively and expressing ideas clearly and concisely.
Salary: Commensurate with qualifications.
Apply: Box 661, c/o ITE Headquarters.

When citizens of St. Louis County, Missouri, saw easy-to-read street name signs going up, they liked the idea. "Not one complaint," says County Highway Engineer John J. Leslie...

"THE TAXPAYERS FAVOR THIS STREET SIGN PROGRAM 100%!"

In late 1958 the St. Louis Metropolitan Traffic Engineers launched a drive for uniform, more readable street and road name signs throughout the area. A model sign of green and white reflective sheeting was proposed by St. Louis County and adopted.

As the new signs began to show up, there was favorable public comment. County Highway Engineer Leslie recalls that the people liked what they saw. The signs, reflectorized with "Scotchlite" Sheeting, were easier to read, especially at night. "As a result," Mr. Leslie says, "every penny spent has been enthusiastically endorsed by our taxpayers."

The City of St. Louis and the Missouri Highway Department also began to install uniform white-on-green signs at corners and intersections. In addition, over 20 local municipalities took part in the program. Here, too, public response was immediately enthusiastic. The St. Louis County municipalities with the latest look in street name signs include: *Bellefontaine Neighbors, Berkeley, Crestwood, Ferguson, Florissant, Hazelwood, Kirkwood, Lakeshire, Marlborough, Moline Acres, Olivette, Overland, Peerless Park, Richmond Heights, Rock Hill, Shrewsbury, Sunset Hills, Sycamore Hills, University City, Wilbur Park, Winchester.*

COUNTY TRAFFIC COMMISSIONER Daniel J. Hanson (left) and Shrewsbury Street Commissioner Edmond Flavin examine one of the new street assemblies made with "Scotchlite" Reflective Sheeting.

MAYOR WALTER L. MEYER (above) of Bellefontaine Neighbors, Missouri, says, "People like to see where their tax dollars are going. Our community is all for this street sign program."

MAYOR GEORGE HELMSING of Shrewsbury, Missouri, exclaims, "So satisfied are we with our new reflectorized street name signs, we now plan to reflectorize all our Stop signs and city entrance signs."

MAKING OR MAINTAINING SIGNS is efficient and economical when a "Scotchlite" Vacuum Applicator does part of the work. William Wenzel of the St. Louis County Sign Shop shows how the applicator permanently bonds reflective sheeting to aluminum panels with professional-looking results.

FOR MORE FACTS about a popular program of street or road name signs for your community, see your 3M Representative. Or write to Dept. RBI-71, 3M Co., St. Paul 6, Minn.

SAME LOOK AT NIGHT carries out the logic of sign uniformity around the clock. This sign, made of "Scotchlite" Reflective Sheeting, is always on duty. It never leaves motorists in the dark.

SCOTCHLITE®
BRAND
REFLECTIVE SHEETING

MINNESOTA MINING AND MANUFACTURING COMPANY
...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

"SCOTCHLITE" IS A REGISTERED TRADEMARK OF 3M COMPANY

YEARBOOK CHANGES

BACCHUS, Grant A. (Associate)
Traffic Engineer, A. D. Margison & Associates, Ltd., 30 Eglinton Avenue East, Toronto, Ontario, Canada. HUdson 1-3301. SEND MAIL: 179 Tavistock Road, Downsview, Ontario, Canada.

BARNETT, Norman C. (Associate)
Traffic Engineering Supervisor, Traffic Engineering Division, Department of Public Works, 112 South Ninth Street, Phoenix 34, Arizona, ALpine 8-7313.

BEWICK, R. D., Jr. (Associate)
Planning Engineer, Delaware State Highway Department, Dover, Delaware. REdfield 4-5733.

BOOTH, James W. (Associate)
Traffic Engineer, Utah State Department of Highways, State Office Building, Salt Lake City 14, Utah. DA 8-5342. SEND MAIL: 1774 East 3990 South, Salt Lake City 17, Utah.

BRANDT, Warren H. (Associate)
City Traffic Engineer, City Hall, Racine, Wisconsin. MElrose 4-7111.

BURTON, Francis C. (Member)
Owner: Francis C. Burton & Associates, 419 Granite, N. W. Albuquerque, New Mexico. CHapel 7-1508.

BURTON, H. Robert (Member)
Traffic Engineer & Consultant, H. G. Acres & Co., Ltd. 3359 Bloor Street West, Toronto 18, Ontario, Canada. BE 9-8115. SEND MAIL: 56 Langmuir Cres. Toronto 9, Ontario, Canada.

CAMPBELL, Lowell Raymond (Junior)
Traffic Engineer, Traffic Operations Branch, Streets & Transit Division; Metropolitan Corporation of Greater Winnipeg, 10 Fort Street, Winnipeg 2, Manitoba, Canada. WH 3-0441, ext. 10.

CICETTI, Gerald L. (Associate)
Civil Engineer. Traffic & Highways Division, Howard, Needles, Tammen & Bergendoff, 99 Church Street, New York 7, New York. WOrth 4-0050. SEND MAIL: 233 Fairway Avenue, Belleville 9, New Jersey.

CLAFFEY, Paul J. (Associate)
Associate Professor, Civil Engineering, Catholic University of America, 625 Michigan Avenue, N. E., Washington 17, D. C. LAwrence 9-6000, ext. 535. SEND MAIL: 3809 13th Street, N. E., Washington 17, D. C.

COPELL, Edgar F. (Member)
Chief Engineer, New England District, DeLeuw, Cather & Co., 361 Boylston Street, Brookline 46, Massachusetts. BEacon 2-1327.

CROSS, Seward E. (Junior)
Associate Traffic Engineer, 8th Floor City Hall, Kansas City 6, Missouri. BAltimore 1-1400. SEND MAIL: 8345 Locust, Kansas City 31, Missouri.

DAVIS, Charles Robert (Associate)
Chief Supervisor, Planning Survey Division, Texas Highway Department, P. O. Box 5051, West Austin Station, Austin 31, Texas. HOmestead 5-6553, ext. 429.

FRITSCHE, Roland H. (Associate)
Traffic Engineer, Milwaukee County Expressway Commission, Court House, Room 9, Milwaukee 3, Wisconsin. BRoadway 6-5800. SEND MAIL: 6226 W. Leon Terrace, Milwaukee 18, Wisconsin.

GALANIS, James G., Jr. (Associate)
Traffic Engineer, San Bernardino County Road Department, 825 East Third Street, San Bernardino, California. TUrner 8-3405, ext. 11. SEND MAIL: 605 West G. Street, Ontario, California.

GOTTSCHALK, Walter D. (Member)
Traffic Advisor, Miami Fire Equipment Co. 150 S. W. 27th Avenue, Miami, Florida. HIghland 4-5733. SEND MAIL: 17531 S. W. 92nd Avenue, Miami 57, Florida.

GREEN, Harry Horton (Associate)
Supervisor of Traffic Engineering, City. 405 First Street, S. W., Cedar Rapids, Iowa. EMpire 4-8121, ext. 40.

GRUBB, Robert W. (Associate)
City Traffic Engineer, East First & Locust Street, Des Moines, Iowa. CHerry 4-2181, ext. 231. SEND MAIL: 1142 Cummins Parkway, Des Moines, Iowa.

GRUENBAUM, Michael T. (Junior)
Principal Transportation Planner, Boston Redevelopment Authority, Room 1108, City Hall Annex, Boston 8, Massachusetts. LAfayette 3-5100, ext. 289.

HENRY, Ellis C., Jr. (Member)
Traffic Commissioner, Room 327 City Hall, St. Louis 3, Missouri. MAin 1-5560, ext. 714.

HILLER, Sherwood H. (Member)
City Traffic Engineer, 316½ North Franklin Street, Tampa 2, Florida. 2-8959.

HOCKING, Richard Jon (Junior)
Director of Public Works, City. Box 87, Two Rivers, Wisconsin. 4-6201.

HOMBERGER, Wolfgang S. (Associate)
Assistant Research Engineer, Institute of Transportation & Traffic Engineering; University of California, 1301 S. 46th Street, Richmond, California. BE 5-6002, ext. 207. SEND MAIL: 280 Columbia Avenue, Berkeley 8, California.

HUNTZICKER, W. P. (Affiliate)
4084 Barfield Road, Memphis 17, Tennessee.

JIVATODE, George R. (Junior)
Traffic Engineer, D. C. Department of Highways & Traffic, District Building, 14th & E Streets, N. W., Washington 4, D. C. NAtional 8-6000, ext. 3466. SEND MAIL: 1910 North 15th Street, Arlington, Virginia.

JOHNS, Kenneth B. (Member)
Director, Division of Traffic, Kentucky Department of Highways, Frankfort, Kentucky. CApitol 7-2231, ext. 293.

JORGENSEN, Roy E. (Member)
Roy Jorgensen & Associates, 7805 Old Georgetown Road, Washington 14, D. C. 656-4215. SEND MAIL: 3709 Chevy Chase Lake Dr. Chevy Chase 15, Maryland.

KOHN, Melvin J. (Associate)
Traffic Engineer & Assistant Operations Manager, Garden State Parkway, 12 Broad Street, Red Bank, New Jersey. SHadyside 1-4600. SEND MAIL: 149 Gary Drive, Trenton 90, New Jersey.

LAKS, Edward E. (Associate)
Traffic Director, Engineering Department, Corporation of the District of Burnaby, 4545 East Grandview-Douglas Highway, Burnaby 2, B. C., Canada. CYprus 8-7211.

LAPP, David Lawrence (Junior)
Traffic Engineer, Bureau of Traffic Engineering & Operations, D. C. Department of Highways & Traffic, District Building, 14th & E Street, N.W., Washington 4, D. C. NAtional 8-6000, ext. 3466.

LINSEMAN, K. G. (Junior)
Traffic & Streets Engineer, Corporation of the City of Kingston, City Hall, Kingston, Ontario, Canada. LIberty 6-4291.

LOMAX, Arthur H. (Associate)
Deputy Director, Department of Traffic, City Hall, Hamilton, Ontario, Canada. JAckson 7-0241.

MacDORMAN, Littleton C. (Junior)
Associate Engineer - Planning; Buchart-Horn, 55 South Richland Avenue, York, Pennsylvania. 3-5561. SEND MAIL: R. D. 2, Red Lion, Pennsylvania.

MANNING, John I. (Associate)
Director of Traffic and City Planning, City Government, Room 1, City Hall, Schenectady 5, New York. FRanklin 4-4121. SEND MAIL: 1590 Wendell Avenue, Schenectady 9, New York.

MARKS, Harold (Associate)
Traffic Planning Engineer, Los Angeles County Road Department, P. O. Box 4089. Terminal Annex, Los Angeles 54, California. CApitol 5-1677. SEND MAIL: 2684 Butler Avenue, Los Angeles 64, California.

MAY, John F. (Associate)
Assistant Operations Engineer, Bureau of Traffic, Illinois Division of Highways, 801 State Office Building, Springfield, Illinois. LAkeside 7-6611, ext. 5080.

McDONALD, Guy D. (Member)
Traffic Engineer, Los Angeles County Road Department, P. O. Box 4089, Terminal Annex, Los Angeles 54, California. CApitol 5-1677, ext. 75244. SEND MAIL: 219 North Gerona Avenue, San Gabriel, California.

McKAY, Benjamin W., Jr. (Associate)
Traffic Control Engineer 4, Department of Public Utilities, 323 Plum Street, Cincinnati 2, Ohio. GArfield 1-5700.

McNEIL, Donald III (Associate)
Assistant Traffic Engineer, Donald M. McNeil Consultant, 223 Fourth Avenue, Pittsburgh 22, Pennsylvania. EXpress 1-1933.

NEVE, James P., Jr. (Junior)
Engineer of Geometric Standards, Traffic Division, Michigan State Highway Department, Stevens T. Mason Building, Lansing 26, Michigan. IVanhoe 5-8144, ext. 2571. SEND MAIL: 2400 Hanover Drive, Lansing 10, Michigan.

NIELSEN, M. Thor (Associate)
Director, Traffic Engineering Department, City. 111 Sussex Drive, City Hall, Ottawa, Ontario, Canada, CEntral 6-7531. SEND MAIL: 410 Tweedsmuir Avenue, Ottawa 3, Ontario, Canada.

PARKER, Harry (Associate)
Supervising Civil Engineer, Los Angeles County Road Department, P. O. Box 4089, Terminal Annex. Los Angeles 54, California. CApitol 5-1677. SEND MAIL: 929 North Curson Avenue, Los Angeles 46, California.

PETERSON, Dennis L. (Junior)
Division Traffic Engineer, Traffic Control Section, Oregon State Highway Department, State Highway Building, Salem, Oregon. EMpire 4-2171. SEND MAIL: 1195 15th St., N.E. Salem, Oregon.

RAINUSSO, Ivonne (Associate)
Ingeniera de Transito, Direccion de Vialidad (M.O.P.) Avda, Uruguay 1120, Montevido, Uruguay. 9-1941. SEND MAIL: Ramon Alvarez 171 La Paz, Dpto. Canelones, Uruguay.

REDFORD, Alex J. (Junior)
Civil Engineer, Whipple, Murphy, Pearson & Assoc. 820 Alaska Building, Seattle 4, Washington. MAin 3-7234. SEND MAIL: 2804 128th Ave., S. E., Bellevue, Washington.

RICE, Joseph F. (Associate)
Chief, Investigations, Surveys, Inventory & Research Division, D. C. Department of Highways & Traffic, District Building, 14th & E Street, N. W., Washington 4, D. C. NAtional 8-6000, ext. 3227 SEND MAIL: 1806 Devine Street, McLean, Virginia.

RICH, Marshall M. (Member)
Associate Traffic Engineer, Wilbur Smith & Associates, Box 7354, Reynolds Station, Winston-Salem, North Carolina. PArk 3-1560.

RICKER, Edmund R. (Member)
Director, Traffic Engineering Bureau, Pennsylvania Department of Highways, 21st and Herr Streets, Harrisburg, Pennsylvania. CEdar 8-5151, ext. 2771. SEND MAIL: 1709 Mitchell Road, Harrisburg, Pennsylvania.

ROTMAN, Morris (Associate)
Traffic Analysis Engineer, Department of Public Works, City. 129 Adelaide Street, W., Room 401, Toronto, Ontario, Canada. EMpire 2-5711, ext. 771. SEND MAIL: 70 Spadina Road, Apt. 615. Toronto 4, Ontario, Canada.

(Continued on page 50)

Highway Research Board Notes

Motorists' Needs on Rural Highways—a paper by C. W. Hartford and Wesley L. Hottenstein, Ohio Turnpike Commission.

Monumental problems will be involved in providing needed services to motorists along thousands of miles of rural freeways based on the service needs along the 241-mile Ohio Turnpike. This, like other toll-roads, has arrangements that will be lacking on most rural expressways. Such facilities include 17 toll plazas, eight pairs of service plazas, eight maintenance buildings and an administration building open 24 hours a day throughout the week and all connected with two-way radio.

In 1959, contract stations handled 33,703 emergency service calls, with more than 90 per cent answered in less than 30 minutes. Leading the list of disablements were out-of-gas incidents with motor trouble a close second. A surprising finding was that 28 per cent of all out-of-gas calls took place within 15 miles after passing a service station, indicating that the motorist's gasoline gauge registered empty when passing the filling station.

Fires on the turnpike are not a big problem in numbers of incidents but many fires are serious when they occur. Over 50 per cent of the vehicular fires are a result of overheated tires caused from under-inflation or improperly functioning wheel bearings. The fires are hard to contain and difficult to put out. Unless equipment is available quickly upon discovery, the fire spreads to the vehicle and often results in complete loss.

Ambulance service is provided through contracts with 16 firms located along the route, and was required 218 times in 1959. The characteristics of a rural freeway, because of isolation and distance, increase the problem of obtaining aid.

In addition to food and lodging, there is a great demand for telephone service. Despite the many calls that are made on credit cards or with reversed charges, on occasion coin boxes have been jammed beyond capacity, putting the phone out of service.

Approximately 12 million people are served annually in the restaurants on the Ohio Turnpike; about $7 million in income is realized from this source.

If gasoline and food were not available along the turnpike, the traffic seeking the services would be channeled to the interconnecting highways creating, in many instances, local problems of congestion.

Effect of Traffic Engineering Improvements on Operations of an Urban Arterial Street—a paper by Edmund A. Hodgkins, U. S. Bureau of Public Roads.

Comparatively simple traffic engineering techniques can vastly improve the traffic carrying capacity of urban arterial streets according to before-and-after studies on Wisconsin Avenue in Washington, D. C. Following the removal of street cars and loading platforms, imposition of parking restrictions, and changes in signal timing, some of the improvements in traffic operation were:

1. Traffic volume increase of up to 47 per cent.
2. Increase of 7 per cent in average speed—from 17.8 to 19.2 mph.
3. During peak hours reduction as high as 86 per cent in the number of stops required in driving the length of the avenue.

The overall increase in average speed can be attributed to the smoother traffic flow provided by the new traffic signal progression and to reduction in mid-block friction. Reduction in delay time at signalized intersections contributed approximately 40 per cent of the northbound average and 10 per cent of the southbound average speed increase. Reduction in mid-block friction helped increase both average and running speeds. The marked decrease in all kinds of stops reduced the time lost in deceleration and acceleration with resultant benefits to average speed and running speed.

Before the improvements were made, a test car had to make between 13 to 25 stops in traveling Wisconsin Avenue; in the "after" study, the number of stops per run averaged from 4 to 8. In upper Georgetown, the number of stops per run has decreased by 80 per cent for the northbound afternoon peak period traffic flow and 86 per cent for the southbound morning peak period flow.

State and Local Urban Highway Planning in Michigan—a paper by Robert F. Van Hoef, Michigan State Highway Department.

Head-on conflicts between urban expressway projects and urban redevelopment programs can be avoided through proper coordination between state highway planners and local planning commissions.

There had been "some dissatisfaction" with the conduct of state-directed highway planning in urban areas. This stems from fears that urban highway programs will not harmonize with the city's master plan. Such fears do not stem so much from past failures in city expressway programs as from the unsolved dilemmas which have become part of the urban problem.

The failure of any metropolitan governmental machinery to erase fractionated governments and to provide a base for dealing with urban problems is still present. Positive land use controls to replace worn-out zoning ordinances must be found. Central business district promotion has failed to stem the tide of retail decentralization. A rebuilding program which will check the tide of blight and deterioration in the central core of the city has yet to be found. And urbanized America is dominated by rurally-dominated state legislatures. No wonder there are some who question . . . whether the city will be properly represented in the decision-making process attending the planning and construction of urban highways.

Procedures have been worked out in Michigan to coordinate highway programs and land use planning. Basically, this involved mutual agreement between the local community planners and the highway department planners on a system of highways. Further, there is agreement that the proposed system is compatible to, and consistent with, existing and proposed development projects and capital improvement programs of the local community.

Such an approach demonstrates to the local communities the real concern of the Highway Department in the proper integration of highway facilities and community development programs.

The coordinated planning approach has been tried in Michigan and found

(Continued on page 54)

MEMBERSHIP APPLICATIONS

The Institute of Traffic Engineers welcomes applications from qualified traffic engineers, but does not desire as members persons who are unqualified. Listed below are the names of those from whom applications for membership or transfer in grade have been received since the last published list. Institute members are urged to review this as soon as possible and immediately inform the Executive Secretary's office if names of people are found who are known to be unqualified for ITE membership or transfer.

New Applications

ADAMS, Clinton Francis
Traffic Engineer II, City of Providence, Rhode Island—for ASSOCIATE.

BAILEY, James D.
Engineer in Charge, Seelye Stevenson Value & Knecht, New Rochelle, New York—for ASSOCIATE.

BOUTWELL, Harvey Bunker
Traffic Research Engineer, New Hampshire Department of Public Works and Highways, Concord, New Hampshire—for ASSOCIATE.

COLE, Leon Monroe
Graduate Student in Transportation Engineering and Planning, University of Washington, Seattle, Washington—for JUNIOR.

COLE, W. Ronald Jack
Special Assistant to Vice President, Ewbank & Partners (Canada) Limited, Toronto, Ontario, Canada—for ASSOCIATE.

DAITER, Morley Louis
Deputy City Engineer, City of Fort William, Ontario, Canada—for JUNIOR.

DREW, Donald R.
Research Assistant and Graduate Student at Texas Transportation Institute of Texas A & M, College Station, Texas—for JUNIOR.

EMERMAN, Stephen Jay
Traffic Engineer, City of West Covina, California—for JUNIOR.

GOURLAY, Stewart M.
Senior Associate Traffic Engineer, Department of Streets and Traffic, City of Detroit, Michigan—for MEMBER.

GUENTNER, Bernard F.
Highway Planning Engineer, H. W. Lochner & Co., Chicago, Illinois—for ASSOCIATE.

KEYSER, Lawrence Edward
Assistant Engineer—Traffic, City of Seattle, Washington—for JUNIOR.

LANDINO, Albert Angelo
Supervising Engineer, Philip W. Genovese & Associates, New Haven, Connecticut—for ASSOCIATE.

LEE, Fred Chu Sen
Acting Traffic Engineer, Department of Highways of Nova Scotia, Halifax, Nova Scotia, Canada—for JUNIOR.

LINGEMAN, Stanley David
Asst. District Traffic Engineer, Michigan State Highway Department, Detroit, Michigan—for JUNIOR.

MAIN, Murray Fotheringham
Assistant Traffic Engineer, City Engineer's Department, City of Regina, Saskatchewan, Canada—for JUNIOR.

MOHLE, Robert Henry
Associate Civil Engineer (Traffic), City of Santa Ana, California—for JUNIOR.

POSTLE, Merton French
Vice President, H. W. Lochner, Inc., Engineers, Chicago, Illinois—for ASSOCIATE.

ROBERTS, Arthur W.
Assistant Civil Engineer—in charge of Isolated Signal Section, Department of Traffic, City of New York, New York—for JUNIOR.

van GELDER, William George
Commanding Officer 62nd Transportation Truck Co., U. S. Army Transportation Corps, Wallace Barracks, Ottawa, Illinois—for JUNIOR.

VOGT, Robert S.
Head, Highway, Traffic and Transportation Department, Vogt, Ivers and Associates, Cincinnati, Ohio—for ASSOCIATE.

Applications for Transfer

BLINDAUER, Harlan Healy
Project and Traffic Engineer, Meissner Engineers, Inc., Reno, Nevada—for ASSOCIATE.

CLEARWATER, Louis L.
Senior Traffic Engineer, Department of Traffic, City of Los Angeles, California—for MEMBER.

GLAZE, C. K.
Principal Planning Engineer, Washington State Department of Highways, Olympia, Washington—for MEMBER.

GRIMM, Vincent Earl, Jr.
Engineer of Design, City of Miami, Florida—for ASSOCIATE.

JACKS, Marshall, Jr.
Senior Assistant Traffic Engineer, Department of Streets and Traffic, City of Detroit, Michigan—for ASSOCIATE.

KNIGHT, Lee Olin
City Traffic Engineer, City of Ponca City, Oklahoma—for ASSOCIATE.

LEMA, Joseph Ernest
Traffic Control Engineer II, Bureau of Traffic Engineering and Electrical Services, Department of Public Works, City of Milwaukee, Wisconsin—for ASSOCIATE.

MARCONI, William
Assistant City Traffic Engineer, Department of Public Works, City of San Francisco, California—for ASSOCIATE.

SMITH, Edwin McMurray
Senior Traffic Engineer, Texas Highway Department, Austin, Texas—for ASSOCIATE.

WOHL, Martin
Assistant Professor of Transportation Engineering, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge 39, Massachusetts—for ASSOCIATE.

YEARBOOK CHANGES **(Continued from page 48)**

RUSHING, James Ben (Junior)
Traffic Engineer, D. C. Department of Highways & Traffic District Building, 14th & E Street, N.W., Washington 4, D.C. NAtional 8-6000, ext. 3466. SEND MAIL: 227 Mississippi Ave., S.E. Apartment #3, Washington 20, D.C.

SADI, Yoshiaki (Associate)
Chief Engineer, Izumo-Kojijimusho, Kensetsu-Sho, 1543 Enya-Cho, Izumo-Shi, Shimane-Ken, Japan.

SAWHILL, Roy B. (Member)
Associate Professor of Civil Engineering, University of Washington, 121 More Hall, Seattle 5, Washington. LAkewood 4-6000, ext. 2864. SEND MAIL: 3808 42nd Avenue, South Seattle 18, Washington.

SCHEMPERS, William, Jr. (Associate)
Traffic Engineer, Engineering Department, Automobile Club of Southern California, Box 2890 Terminal Annex, Los Angeles 54, California. RIchmond 8-3111.

SETTEDUCATO, Nicholas M. (Associate)
Associate; Edwards & Kelcey, 3 William Street, Newark 2, New Jersey. MArket 3-1804.

SHELLMER, Richard A. (Associate)
Traffic Engineer; Parsons, Brinckerhoff, Quade & Douglas, 165 Broadway, New York 6, New York. BEckman 3-6300. SEND MAIL: 10 Wayne Boulevard, Madison, New Jersey.

SHERIDAN, Richard Brinsley (Junior)
Assistant Research Engineer, Institute of Transportation & Traffic Engineering, University of California, Los Angeles 24, California. BRadshaw 2-6161. SEND MAIL: 11246 Culver Park Drive, Culver City, California.

SHOCKEY, Jack W. (Associate)
District Manager, Elizabeth Division of the Elastic Stop Nut Corp. of America, 1027 Newark Avenue, Elizabeth 3, New Jersey. 2-2900. SEND MAIL: 6742 West 5th Place, Denver 26, Colorado.

STANFORD, Malcolm R. (Associate)
Traffic Operations Engineer, Los Angeles County Road Department, P. O. Box 2089, Terminal Annex, Los Angeles 54, California. CApitol 5-1677. SEND MAIL: 1691 Kempton Avenue, Monterey Park, California.

STEWART, William A. (Associate)
Head; Transportation & Municipal Division A. D. Margison & Assoc., Ltd. 30 Eglinton Avenue East, Toronto, Ontario, Canada. HUdson 1-3301.

STOVER, Vergil G. (Junior)
Research Assistant; Joint Highway Research Project, Purdue University, Civil Engineering Building, Lafayette, Indiana. 92-2589.

SULLIVAN, Thomas Darcy (Junior)
Traffic Engineer; Barton-Aschman Associates, 600 Davis Street, Evanston, Illinois. UNiversity 9-0660.

SUMNERS, James H. (Associate)
Assistant State Manager, Traffic & Planning Division, Mississippi State Highway Department, 412 Woodrow Wilson, Jackson, Mississippi. FLeetwood 2-8831.

THOMAS, Richard C. (Associate)
Assistant Traffic Engineer, Planning & Surveys, City and County of Denver, City and County Building, Denver, Colorado. MAin 3-1133. SEND MAIL: 744 South Ivy Street, Denver 22, Colorado.

TREITERER, Joseph (Associate)
Head, Traffic & Safety Division, National Institute for Road Research, Private Bag 191, Pretoria, Union of South Africa. 3-1261.

TUC, Le-canh (Junior)
Planning and Research Engineer, Highway Department, 55 Pasteur, Saigon, Viet-Nam, 2-1043, ext. 62. SEND MAIL: 154 Ton-That-Hiep, Cholon, Viet-Nam.

VANNICE, Robert E. (Associate)
Design Engineer, Cuyahoga County Engineer's Office, 1918 Standard Building, Cleveland 13, Ohio. TOwer 1-5211.

WARNBERG, Donald R. (Associate)
Associate Engineer, Traffic Division, Colorado Department of Highways, 4201 East Arkansas Avenue, Denver 22, Colorado. SKyline 6-1531. SEND MAIL: 1424 South Garfield Street, Denver 10, Colorado.

WATSON, Frank L. (Associate)
Senior Traffic Engineer, Traffic & Transportation Department, 702 City Hall, Houston 2, Texas. CApitol 2-9351, ext. 8261.

WILKES, John B. (Associate)
Planning Engineer, Planning and Design Branch, Ontario Department of Highways, Parliament Buildings, Toronto, Ontario, Canada. CHerry 4-2571, ext. 571. SEND MAIL: 57 Larabee Crescent, Don Mills, Ontario, Canada.

WILLIAMS, Robert Carroll, Jr. (Associate)
Traffic Engineer, Traffic and Planning Associates, P. O. Box 1691, Hickory, North Carolina. DAvis 7-2621.

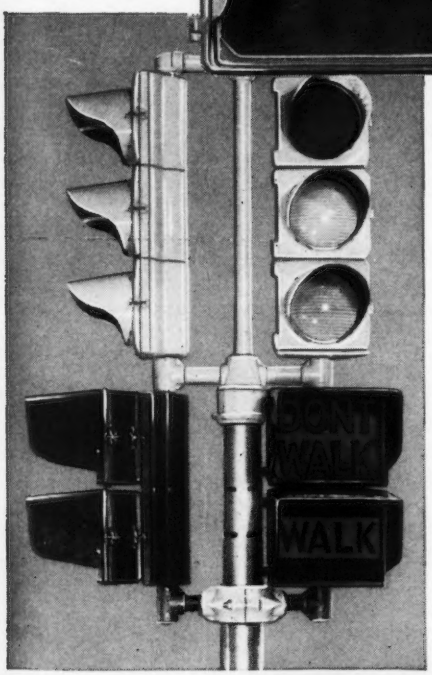
WILLIS, Charles L. (Junior)
Traffic Engineer, Division of Traffic, Kentucky Department of Highways, 415 Ann Street, Frankfort, Kentucky. CApitol 7-2231, ext. 292.

New CROUSE/HINDS

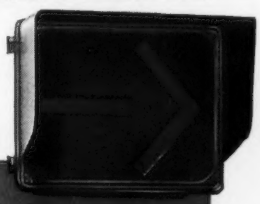
INCANDESCENT

Pedestrian Traffic Signal

MP-120



ABOVE — MP-120 Installed on Standard Signal



RIGHT—Arrow for Vehicular Use MP-110

- **Larger . . . brighter . . . more readable**
- **37% more effective lens area . . . 9″ x 11″ prismatic lens**
- **Ideal for crossings 50′ - 60′ wide**

Ideally suited to residential areas, school crossings, small shopping centers, etc., the MP-120 offers significant savings over more expensive neon units designed for crossings up to 125′ in width.

The "Walk/Don't Walk" legends and the rectangular shape of the signal distinguish it instantly as a signal for pedestrians . . . impossible to confuse with circular signals for vehicular traffic.

Simple in design, modern in appearance, the MP-120 mounts with standard signal brackets, without special fittings. Arrow indicators, in place of "Walk/Don't Walk" legends, are available for multiple-street vehicular indications.

For engineering and service assistance, Crouse/Hinds maintains a nationwide network of sales engineers and distributors to assist you in engineering and service situations. For the name of the Crouse/Hinds representative nearest you, call or write any branch office.

WRITE for Bulletin #2716 containing complete information and specifications on the MP-120 Pedestrian Traffic Signal today.

CROUSE HINDS
SYRACUSE NEW YORK

Offices: Atlanta, Baton Rouge, Birmingham, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Corpus Christi, Dallas, Denver, Detroit, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Oregon, St. Louis, St. Paul, Salt Lake City, San Francisco, Seattle, Tulsa, Washington. Resident Representatives: Albany, Baltimore, Reading, Pa., Richmond, Va.
Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.
Crouse-Hinds Instrument Company, Inc., Silver Spring, Md.

Professional Service Directory

TRAFFIC TRANSPORTATION PARKING
EXPRESSWAYS AIRPORTS PUBLIC WORKS
Surveys — Reports — Design — Supervision

EDWARDS AND KELCEY
Engineers and Consultants
3 William Street, Newark 2, New Jersey
Boston Salt Lake City New York
Providence Minneapolis

LAWRENCE S. WATERBURY
CONSULTING ENGINEER
26 Broadway
New York 4, N. Y.
Bowling Green 9-9298

Traffic — Parking — Highways — Transit
Design Consulting — Financing Aids
City Planning — Urban Redevelopment
E. A. BARTON and ASSOCIATES
CONSULTANTS
Cleveland Transit Bldg., Cleveland 14, Ohio
Cherry 1-0600
San Francisco Baltimore Toronto
St. Louis

DE LEUW, CATHER & COMPANY
CONSULTING ENGINEERS
Public Transit — Subways
Traffic & Parking — Railroad Facilities
Expressways — Industrial Plants
Grade Separations — Municipal Works
Urban Renewal — Port Development
150 North Wacker Drive, Chicago 6
San Francisco New York Boston

TRAFFIC RESEARCH CORPORATION
TRANSPORTATION PLANNING FOR METROPOLITAN AREAS AND HIGHWAY SYSTEMS
Traffic Signal Systems — Origin and Destination Surveys
Expressway and Public Transit Assignments
Traffic Surveys — Economic and Distribution Studies — Traffic Simulations
10 Columbus Circle, New York 19, N. Y.
20 Spadina Road, Toronto 4, Canada

YOUR CARD
COULD BE SET IN THIS SPACE
AT A VERY REASONABLE RATE
If interested, please write
INSTITUTE OF TRAFFIC ENGINEERS
2029 K Street NW, Washington 6, D. C.

ALAN M. VOORHEES & ASSOCIATES
City Planning
Traffic Engineering - Transportation Planning
Consultants
1832 M Street, N. W. Washington, D. C.

PARTICIPATING ORGANIZATIONS

(Continued from page 45)

The Marbelite Company, Inc.
179 N. 10th St. Brooklyn 11, N. Y.
William E. Lenz, Representative

Minnesota Mining and Mfg. Co.
900 Bush Avenue St. Paul 6, Minnesota
Donald O. Opstad, Representative

Motorola Communications and Electronics, Inc.
4501 West Augusta Blvd. Chicago 51, Ill.
Stanley H. Burg, Representative

Outdoor Advertising Association of America, Inc.
24 W. Erie St. Chicago 10, Ill.
Don Martin, Representative

Pfaff & Kendall
84 Foundry Street Newark 5, N. J.
George C. Masefield, Representative

Prismo Safety Corporation
Huntingdon Pennsylvania
John C. Horn, Representative

Stimsonite Signal Products Elizabeth Division of ESNA
1027 Newark Ave. Elizabeth 3, N. J.
John F. Brady, Representative

Streeter-Amet Company
Grayslake Illinois
George F. Graham, Representative

The Union Metal Manufacturing Company
1432 Maple Ave., N.E. Canton 5, Ohio
K. C. Dorland, Representative

United States Steel Corporation
525 William Penn Place Pittsburgh 30, Pa.
Robert S. Holmes, Representative

INDEX TO ADVERTISERS

Automatic Signal Division of Eastern Industries	55
Cataphote Corporation	8
Crouse-Hinds Company	51
Duncan Parking Meter Company	2
Eagle Signal Company	10
Flex-O-Lite Manufacturing Corporation	4
Hall Sign and Post Company	40
Kar-Trol Signal Company	31
Magee-Hale Park-O-Meter Company	6
The Marbelite Company	41
Minnesota Mining and Manufacturing Company	46 & 47
Miro-Flex Company	25
Nix-Pix Locks	29
Pam Company	54
Planet Corporation	27
Prismo Safety Corporation	Back Cover
Radiator Specialty Company	13
Rockwell Manufacturing Company (Dual)	43
B. G. Reilly Company	32
Stimsonite Signal Devices	23
Time-O-Matic, Incorporated	30
Traffic Signals, Incorporated	3
Union Metal Manufacturing Company	9

Professional Service Directory

TRAFFIC ENGINEERING HIGHWAY PLANNING

BRUCE CAMPBELL & ASSOCIATES
ENGINEERS

177 MILK STREET • BOSTON 9

PARKING AIRPORTS SHOPPING CENTERS

PARSONS, BRINCKERHOFF QUADE & DOUGLAS
Engineers

Bridges, Highways, Tunnels, Airports, Subways, Harbor Works, Dams, Canals, Traffic, Parking and Transportation Reports, Power, Industrial Buildings, Housing, Sewerage and Water Supply.

165 Broadway **New York 6, N. Y.**

CRAWFORD, MURPHY & TILLY
CONSULTING ENGINEERS

Water Works - Impounding Reservoirs
Highway - Municipal Streets - Expressways
Traffic Problems - Airports
Swimming Pools
Sewers - Sewage Treatment
Waste Treatment - Storm Drainage
Flood Control - Surveys and Reports

755 So. Grand Ave., W.; Springfield, Ill.
Lakeside 8-5619

HOWARD, NEEDLES TAMMEN & BERGENDOFF
Consulting Engineers

Traffic Analyses **Transportation Studies**
Parking

Express Highway Planning
Reports and Design Administrative Services
Foundations and Airports

1805 Grand Avenue
Kansas City 8, Missouri
New York **Cleveland**

HARDESTY & HANOVER
CONSULTING ENGINEERS

BRIDGES — Long Spans of All Types
Movable — Lift, Bascule & Swing
Hanover Skew Bascule
Grade Crossing Eliminations
Other Structures Foundations
Expressways and Thruways
Design — Supervision — Inspection
Valuation — Reports

101 Park Avenue **New York 17, N. Y.**

PALMER AND BAKER ENGINEERS, INC.
CONSULTING ENGINEERS — ARCHITECTS

Surveys — Reports — Design — Supervision — Consultation

Transportation and Traffic Problems Tunnels Bridges Highways Airports
Industrial Buildings Waterfront and Harbor Structures
Graving and Floating Dry Docks
Complete Soils, Materials and Chemical Laboratories

Mobile, Ala. **New Orleans, La.** **Washington, D.C.**

S. Herbert Taylor Frank J. Sleeper
David L. Taylor William H. Taylor

SHERMAN, TAYLOR & SLEEPER
CONSULTING ENGINEERS
(All phases of Civil Engineering)

501 Cooper Street, Camden 2, N. J.
WOodlawn 6-2552

Park & Norwood Aves., Merchantville 8, N.J.
NOrmandy 3-4848

GANNETT FLEMING CORDDRY and CARPENTER, INC.
---ENGINEERS---

CONSULTING SERVICE FOR TRAFFIC PARKING and TRANSPORTATION PROBLEMS
City Planning — Highways — Bridges — Flood Control
Water Supply — Sewerage — Industrial Waste — Garbage Disposal
Appraisals — Investigations — Management

600 NO. 2nd STREET HARRISBURG, PA.
Pittsburgh, Pa. Philadelphia, Pa. Daytona Beach, Fla. Medelin, Colombia, S.A.

JENKINS, MERCHANT & NANKIVIL
CONSULTING ENGINEERS

Municipal Improvements Gas Systems
Highways & Airports Water Systems
Power Development Sewerage Systems
Traffic Surveys Industrial Plants
Flood Control Recreational Facilities
Investigations and Reports

801-805 East Miller St. **Springfield, Ill.**

BARTON-ASCHMAN ASSOCIATES, INC.
Engineering and Planning Consultants

- Comprehensive Traffic and Transportation Planning
- Detailed Traffic and Signal Improvement Studies
- Parking Programs and Feasibility Analyses

600 Davis Street **Evanston, Illinois**

RAMP CONSULTING SERVICES, INC.
Parking Programs • Feasibility Studies

RAMP ENGINEERING ASSOCIATES
Engineering and Design Services

2 West 46th Street, New York 36, N. Y.

TIPPETTS — ABBETT McCARTHY — STRATTON
Engineers
Traffic, Parking and Transportation

Surveys, Economic Studies and Financial Reports

Highways, Subways, Bridges Tunnels — Airports, Ports, Harbors, Power Developments, Water Supply, Sewerage

Planning, Reports, Design, Supervision of Construction

375 Park Avenue 110 Market St.
New York 22, N. Y. San Francisco, Calif.

Highways **Transit**
Traffic **Parking**

WILBUR SMITH & ASSOCIATES
495 Orange Street
New Haven, Connecticut

Columbia • San Francisco • Richmond
S. C. **Calif.** **Va.**

HIGHWAY TRAFFIC ENGINEERS, INC.
Traffic - Parking - Transportation
Economic Studies - Financial Reports
Traffic Control - Design of Lighting Systems and Communications

361 Boylston Street
Brookline 46, Massachusetts
LOngwood 6-0275

ALFRED KAEHRLE ASSOCIATES
CONSULTING ENGINEERS

Highway Planning — Highway Design
Traffic Engineering Surveys
Parking Studies — Shopping Centers

10 North Main Street
West Hartford 7 **Connecticut**

HIGHWAY RESEARCH NOTES

(Continued from page 49)

to work. Definition of procedures and techniques is satisfactory and steadily improving. And finally, the recognition of new responsibilities in the urban areas has brought a new excitement to highway planners as they become partners with local planners in rebuilding Michigan cities.

Boston Parking Problems—a paper by Herman Carp, Massachusetts Parking Authority.

The principal target in Boston's massive attack on its parking problem is the half-square-mile downtown retail area. By use of condemnation procedures and leasing the facilities to private operators, Boston has provided off-street space for 3,000,000 vehicles annually.

Not only is the program meeting with great public approval, but it has proved a self-liquidating venture. Although the investment of the city has been only $13 million, at the end of 1959, the city finds itself the owner of parking facilities valued at over $25 million and the Real Property Board has been able to turn over $6 million in collected rents into the general funds of Boston.

In districts where the land costs were not prohibitive, large areas were taken for ramp structures and metered lots. In the highest assessed retail district, small areas of less than 20,000 feet were taken, and high-rise, 10-14 story mechanical facilities were created. In this manner, land areas which normally accommodate 60 cars, by the use of vertical-horizontal elevator equipment, were made to accommodate 700 cars, with a consequent reduction in per-car land cost.

Most difficult, and most litigated, portion of the program was the construction of a large parking facility under the Boston Common to serve the State House area as well as the "carriage trade" district of Tremont and Boylston Streets and also Beacon Hill. After many setbacks, the State Legislature in 1958 enacted a measure creating the Massachusetts Parking Authority and empowered it to take portions of the Common from the City of Boston by eminent domain. This novel grant of power was subsequently upheld by the Supreme Judicial Court and work was promptly started. A completion date has been set for September 1961 for the new facility which will provide spaces for 1500 cars.

Section News

MISSOURI VALLEY SECTION

New officers were elected at the annual meeting in Columbia, Missouri, on May 16 as follows:

President—George C. Lichty
Vice-President—Daniel J. Hanson
Secretary-Treasurer—
C. Harold Miller
Room 411 City Hall
Tulsa, Oklahoma

MICHIGAN SECTION

New officers of the Michigan Section, elected at the annual meeting held on May 11, 1961, are:

President—
Captain Harold L. Hickman
Vice-President—Frank A. Ronan
Secretary-Treasurer—
Keith Bushnell
Traffic Division
Michigan State Highway Department
Stevens T. Mason Building
Lansing 26, Michigan

METROPOLITAN (NY) SECTION

New officers elected at the June meeting are:

President—Ernest A. Boulding, Jr.
Vice President—George R. Roy
Secretary-Treasurer—
Robert J. Nolan
Rocktown Road RD #1
Lambertville, New Jersey

WASHINGTON (D.C.) SECTION

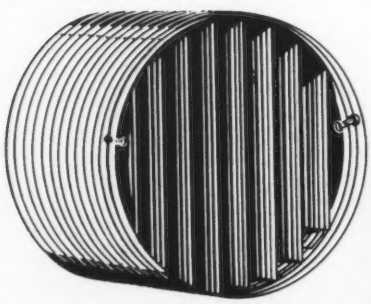
New officers for the Washington Section elected at the June meeting are:

President—William L. Carson
Vice President—Robert A. Keith
Secretary-Treasurer—
Edward F. Cleary
Department of Transit & Traffic
401 E. Pratt Street
Baltimore 2, Maryland

Indiana Section Meeting During the Forty-Seventh Annual Purdue Road School

Pictured left to right are: Mr. K. A. Stonex, Asst. Director, General Motors Proving Ground, Milford, Michigan; Mr. C. M. Foster, Executive Director, Indiana State Highway Commission; Mr. A. C. Malo, President, Institute of Traffic Engineers; Mr. S. T. Siegel, President, Indiana Section, Institute of Traffic Engineers; Mr. H. B. Woodling, District 3 Director, Institute of Traffic Engineers; Prof. K. B. Woods, Head, School of Civil Engineering, Purdue University; Mr. C. P. St. Clair, Director, Highway Cost Allocation Study, Bureau of Public Roads, Washington,

STOP *the practice of "jumping the light" at intersections by motorists and pedestrians . . .*



STRAITRAY

Scientifically Controls Traffic Signal Visibility

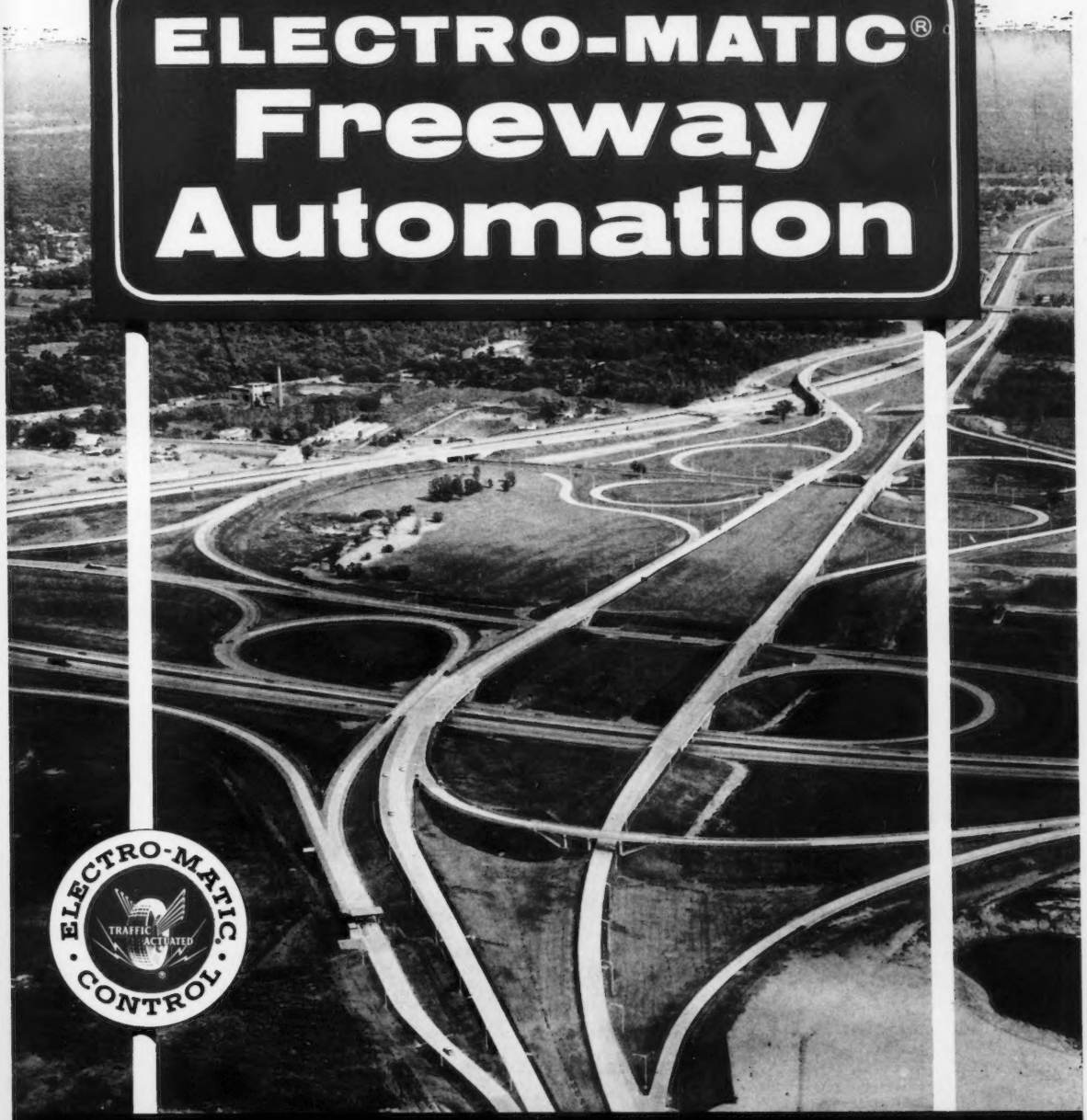
With STRAITRAY there is no advance "tip off" as to when light is about to change. Now you can do a better, more effective job on your Signal System at small additional cost. Light is seen only by motorist or pedestrian required to obey the signal.

Write for FREE technical brochure and price schedule:

PAM COMPANY
1951-B N.W. Wilson Street
Portland 9, Oregon

Get Maximum Production • Service • Safety on Freeways with

ELECTRO-MATIC® Freeway Automation



Entrance Ramp Control
Tunnel Ventilation Control
Surveying and Data Processing
Exit Ramp Clearing
Lane Control
Speed Limit Changing
Area Control Center Automation

Send for Electro-Matic Freeway Automation Brochure (No. F-101)

EASTERN INDUSTRIES
NORWALK, CONNECTICUT

A DIVISION OF LABORATORY FOR ELECTRONICS, INC.

In city after city across the USA

The story is the same...

PRISMO PLASTIX "SD"

BY POPULAR DEMAND!

More and More Traffic Engineers are recognizing rugged, long-wearing Prismo Plastix SD as THE answer to the need for a material to stand up in high density locations. They praise Prismo Plastix for the ease and speed with which it goes down and molds to the pavement, for its resistance to dirt, wear and moisture, for its immediate reflectivity and amazing durability, its versatility of shapes and sizes, its basic economy and low maintenance cost.

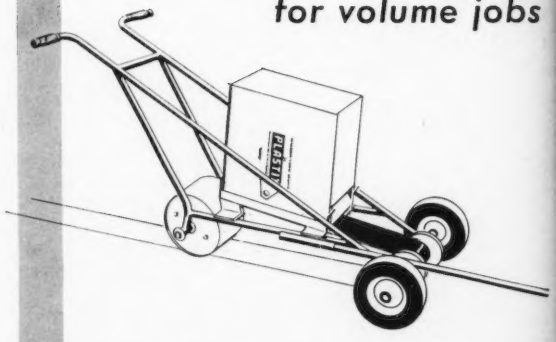
PRISMO

PRISMO SAFETY CORPORATION
Huntingdon, Pennsylvania

and now...**THE WALD**

PLASTICATOR

for volume jobs



Makes continuous application of solid line Plastix easier than painting. In one application it peels, then presses the markings into firm position. Saves time, insures a straight, neat job.